Prevention of Ventilator Associated Pneumonia: Guidelines and New Insights

A Lecture for CHICA, Winnipeg, Canada
June 1, 2012

Robert Garcia, BS, MMT(ASCP), CIC
Infection Control Preventionist
Magnitude of the Problem
VAP Facts

- Third most common HAI and most common among ICU patients
- Second most costly HAI
- Between 10% and 20% of patients receiving >48 hours of mechanical ventilation will develop VAP
- Rates of VAP range from 1 to 4 cases per 1000 ventilator-days, but rates may exceed 10 cases per 1000 ventilator-days in some neonatal and surgical patient populations

## Relative Costs of HAIs

<table>
<thead>
<tr>
<th></th>
<th>Rate per 100 admits</th>
<th>Proportion of all HAIs</th>
<th>Excess Hospital Days</th>
<th>Proportion of costs of all HAIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTI</td>
<td>2.5</td>
<td>35%</td>
<td>1-2</td>
<td>15%</td>
</tr>
<tr>
<td>SSI</td>
<td>1.5</td>
<td>20%</td>
<td>7</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Pneumonia</strong></td>
<td><strong>1.0</strong></td>
<td><strong>15%</strong></td>
<td><strong>10</strong></td>
<td><strong>30%</strong></td>
</tr>
<tr>
<td>BSI</td>
<td>1.0</td>
<td>15%</td>
<td>10-12</td>
<td>5%</td>
</tr>
</tbody>
</table>
## Cost of VAP

<table>
<thead>
<tr>
<th>Study/Year</th>
<th>#Pts with VAP</th>
<th>Measure</th>
<th>ICU Type</th>
<th>Cost with VAP</th>
<th>Cost without VAP</th>
<th>Cost per VAP case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kolef 2012</td>
<td>2238</td>
<td>Attributable cost</td>
<td>ICU</td>
<td>$99,598</td>
<td>$59,770</td>
<td>$39,828</td>
</tr>
<tr>
<td>Rello 2002</td>
<td>842</td>
<td>Charges</td>
<td>Med, surg, trauma</td>
<td>$104,983</td>
<td>$63,689</td>
<td>$41,294</td>
</tr>
<tr>
<td>Cocanour 2005</td>
<td>70</td>
<td>Attributable cost</td>
<td>Trauma</td>
<td>$82,195</td>
<td>$25,037</td>
<td>$57,158</td>
</tr>
<tr>
<td>Kollef 2005</td>
<td>499</td>
<td>Charges</td>
<td>Various ICUs</td>
<td>$150,841</td>
<td>__</td>
<td>$150,841</td>
</tr>
</tbody>
</table>


Conclusion: Our findings suggest that VAP continues to occur as defined by the new specific ICD-9 code and is associated with a statistically significant resource utilization burden, which underscores the need for cost-effective interventions to minimize the occurrence of this complication.
Impact of HAIs on LOS

Avg. LOS w/o HAI = 4.6 days

Pennsylvania Healthcare Cost Containment Council, PHC4 Research brief, March 2006
Definitions
## Definitions

<table>
<thead>
<tr>
<th>Pneumonia Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAP</td>
<td>Patients receiving mechanical ventilation for at least 24h with a first positive bacterial respiratory culture finding after ventilator start date</td>
</tr>
<tr>
<td>HAP</td>
<td>Patients with a first positive bacterial respiratory culture finding &gt;2 days from admission who do not meet VAP definition</td>
</tr>
<tr>
<td>HCAP</td>
<td>Patients with a first positive bacterial respiratory culture finding within 2 days of admission and any of the following: (1) admission source indicates a transfer from another health-care facility; (2) receiving long-term hemodialysis (ICD-(-CM codes); and (3) prior hospitalization within 30 days who do not meet VAP definition</td>
</tr>
<tr>
<td>CAP</td>
<td>Patients with a first positive bacterial respiratory culture finding who do not meet VAP or HCAP definition</td>
</tr>
</tbody>
</table>

### Pneumonia Breakdown

<table>
<thead>
<tr>
<th>Pneumonia Category</th>
<th>Patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAP</td>
<td>499</td>
<td>11.0</td>
</tr>
<tr>
<td>HAP</td>
<td>835</td>
<td>18.4</td>
</tr>
<tr>
<td>HCAP</td>
<td>988</td>
<td>21.7</td>
</tr>
<tr>
<td>CAP</td>
<td>2221</td>
<td>48.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4543</strong></td>
<td></td>
</tr>
</tbody>
</table>

Improving Surveillance for Ventilator Associated Events in Adults

“It is necessary to have objective reliable surveillance for definitions for use in public reporting and inter-facility comparisons of event rates and federal pay-for-reporting and performance programs.”

New Definition
- Detects complications and conditions including, but not limited to VAP
- Requires a minimum period of time on ventilator
- Focuses on readily available, objective, clinical data
- Does not include chest radiograph findings

The goal for implementation in NHSN (National Healthcare Safety Network) is January 2013.

Available at http://www.cdc.gov/nhsn/PDFs/vae/CDC_VAE_CommunicationsSummary-for-compliance_20120313.pdf
Quality Impact
Response to a Nationally Recognized Problem

• Institute for Healthcare Improvement: 5,000,000 Lives Campaign
• National initiative to reduce healthcare errors, infections, and associated death
• Started 2005
• >3000 U.S. hospitals currently participating
• Addresses specific healthcare-acquired infections
  – CLAB
  – VAP
  – SSI
  – “bundle” approach = revision of system components based on scientific evidence of effectiveness

http://ihi.org/IHI/Programs/Campaign/Campaign.htm
Financial Incentives: If It’s Not POA, We Won’t Pay (CMS)

Conditions No Longer Covered

• Falls
• Mediastinitis (after heart surgery)
• Pressure Ulcers
• Vascular and Urinary Tract Infections from Catheters
• “Never Events”
  – Objects left in body during surgery
  – Air embolisms
  – Blood incompatibility
• POA Tracking to start 10/07
  • Non-payment 10/08
“…..First, reducing errors to zero requires a series of steps and changes --- often no one of which is, by itself, that significant. It is rather, the sum total of 100 one percent changes that add up to achieve the 100 percent solution. Safety results from redesigning processes, simplifying them, making them less prone to error, improving communication, establishing protocols (and following them) – all the result of teams of caregivers getting together to try to meet a seemingly unreachable goal. And second, unless everyone in the hospital assumes personal responsibility for improving patient safety, none of the above-mentioned changes will occur. This personal commitment to patient safety is a necessary ingredient to change an unsafe system…..”

-- W.R. Brody, MD. PhD, president of Johns Hopkins University, Change: A Biweekly Forum for Johns Hopkins faculty and Senior Staff, July 21, 2004
Pathogenesis
Major Areas of Oropharyngeal Colonization

- Lips & gums
- Teeth
- Tongue
- Tissues
- Secretions above the vocal cords
- Secretions above the cuff
- Endotracheal tube
tube cuff
- Nasogastric tube
- Esophagus
- Oropharynx
- Secretions in the mouth
How Biofilms Form

1. Attachment
2. Growth
3. Detachment
Biofilm forming over 12 hours

http://helios.bto.ed.ac.uk/bto/microbes/biofilm.htm
Plaque as a Biofilm

Linking Oral and Dental Colonization with Respiratory Infection

- A review of the published evidence linking oropharyngeal colonization and respiratory infection, including VAP (20 studies)
- Provides suggested oral and dental interventions, some beyond the scope of current guidelines

Prevention Strategies
IHI Recommendations

- Head of bed elevation to 30°
- Daily “sedation vacation” and daily assessment of readiness to extubate
- Peptic ulcer disease (PUD) prophylaxis
- Deep vein thrombosis (DVT) prophylaxis

Available at IHI.org
Recent VAP Prevention Guidelines


### SHEA/IDSA: Guideline Categories

<table>
<thead>
<tr>
<th>Category/Grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength of Recommendation</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Good evidence to support a recommendation for use</td>
</tr>
<tr>
<td>B</td>
<td>Moderate evidence to support a recommendation for use</td>
</tr>
<tr>
<td>C</td>
<td>Poor evidence to support a recommendation</td>
</tr>
<tr>
<td><strong>Quality of Evidence</strong></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Evidence from ≥ 1 properly randomized, controlled trial</td>
</tr>
<tr>
<td>II</td>
<td>Evidence from ≥ 1 well-designed clinical trial, without randomization; from cohort or case-control analytic studies (preferably from &gt; 1 center); from multiple time series; or from dramatic results from uncontrolled experiments</td>
</tr>
<tr>
<td>III</td>
<td>Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees</td>
</tr>
</tbody>
</table>
### HICPAC Guideline Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>A strong recommendation supported by high to moderate quality evidence suggesting net clinical benefits or harms</td>
</tr>
<tr>
<td>IB</td>
<td>A strong recommendation supported by low quality evidence suggesting net clinical benefits or harms or an accepted practice (e.g., aseptic technique) supported by low to very low quality evidence</td>
</tr>
<tr>
<td>IC</td>
<td>A strong recommendation required by state or federal regulation.</td>
</tr>
<tr>
<td>II</td>
<td>A weak recommendation supported by any quality evidence suggesting a trade off between clinical benefits and harms</td>
</tr>
<tr>
<td><em>No recommendation/Unresolved issue</em></td>
<td>Unresolved issue for which there is low to very low quality evidence with uncertain trade offs between benefits and harms</td>
</tr>
<tr>
<td>Issue</td>
<td>SHEA/IDSA 2008</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>General Strategies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Elevate Head of the Bed</strong></td>
<td>• Maintain patients in a semi-recumbent position (30°-45° elevation of the head of the bed) unless there are contraindications.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that all patients (except those with medical contraindications) are maintained in a semirecumbent position (B-II)</td>
</tr>
<tr>
<td></td>
<td>• Recent studies indicate that semirecumbent positioning is rarely maintained, and may not be associated with a reduced rate of tracheal colonization or VAP.</td>
</tr>
</tbody>
</table>
Elevate the HOB: Lower than 30?

- Randomized controlled study that disputes study referenced by CDC to recommend use of semirecumbent positioning to prevent VAP

- Study is unique in three aspects:
  - Patient positioning was continuously monitored in first week
  - The semirecumbent position was compared to the standard of care
  - Data analyzed according to the intention-to-treat principle

- Results:
  - Patients in supine position (control) reached only 9.8 to 14.8 degrees (i.e., standard of care)
  - Mean backrest position in study group was 30 degrees
  - No difference in VAP rates between the groups

Recent HOB Study

• Study on improving HOB elevation protocol

• 2012, MICU, Denver Health Med Ctr

• HOB elevation monitored two ways - bed displays and/or alarms. Manual checks twice daily.

• Results:
  – Of 7720 monitored hours...
    • 5542 hrs were in beds that continuously displayed HOBE and provided alarm to central station - adherence rate was 76%
    • 2178 hrs were in beds that did not have in-room displays - adherence rate was 61%

What is 30 degrees?

In simulated experiment 50% to 86% of clinicians correctly perceived HOB

HOB Limitations

- Low BP/unstable VS
- Agitated and at risk of falling out of bed
- Compromised circulation due to femoral lines
- Spinal clearance/Spinal cord injury patients - **MUST** have a physician’s order identifying the degree of elevation allowed
<table>
<thead>
<tr>
<th>Issue</th>
<th>SHEA/IDSA 2008</th>
<th>HICPAC 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subglottic secretion drainage</td>
<td>• Use an endotracheal tube with inline and subglottic suctioning for all eligible patients. (B-II)</td>
<td>• If feasible, use an endotracheal tube with a dorsal lumen above the endotracheal cuff to allow drainage (by continuous or frequent intermittent suctioning) of tracheal secretions that accumulate in the patient’s subglottic area. <em>Category II</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Maintain an endotracheal cuff pressure of at least 20 cm H2O.</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>SHEA/IDSA 2008</td>
<td>HICPAC 2003</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Special Approaches</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stress Ulcer Prophylaxis</strong></td>
<td>• Avoidance of H2 antagonist or proton pump inhibitors for patients who are not at high risk for developing gastrointestinal bleeding (unresolved issue)</td>
<td>• <em>No recommendation can be made for the preferential use of sucralfate, H2-antagonists, or antacids for stress-bleeding prophylaxis in patients receiving mechanically assisted ventilation (unresolved issue)</em></td>
</tr>
</tbody>
</table>
Stress Ulcer Prophylaxis


- 7 meta-analyses, >20 studies
- 4 showed significant VAP reductions
- 3 showed similar but non-significant VAP reductions


- Large randomized trial showed no benefit in either sucralfate or H2 antagonists


- randomized, placebo-controlled trial, 287 pts.
- studied omeprazole (PPI), famotidine (H2 antagonist), sucralfate
- No significant differences in bleeding or pneumonia rates among the 4 groups
<table>
<thead>
<tr>
<th>Issue</th>
<th>SHEA/IDSA 2008</th>
<th>HICPAC 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategies to reduce colonization of aerodigestive tract</td>
<td>• Perform regular oral care with an antiseptic solution. The optimal frequency for oral care is unresolved</td>
<td>• Develop and implement a comprehensive oral-hygiene program (that might include the use of an antiseptic agent) for patients in acute-care settings or residents in long-term care facilities who are at high risk of developing health-care-associated pneumonia. Category II</td>
</tr>
<tr>
<td>Oral Care</td>
<td>• Perform regular antiseptic oral care in accordance with product guidelines. (A-I)</td>
<td>• No recommendation can be made for the routine use of an oral chlorhexidine rinse for the prevention of health-care associated pneumonia in all postoperative or critic. Unresolved Issue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No recommendation can be made for the routine use of topical antimicrobial agents for oral decontamination to prevent VAP. Unresolved Issue</td>
</tr>
</tbody>
</table>
1. Elevation of the head of the bed (HOB) to between 30 and 45 degrees
2. Daily “sedative interruption” and daily assessment of readiness to extubate
3. Peptic ulcer disease (PUD) prophylaxis
4. Deep venous thrombosis (DVT) prophylaxis (unless contraindicated)

In the spring of 2010, IHI faculty determined that there is support in the evidence for the addition of a fifth element in this work:

5. Daily oral care with chlorhexidine
- Q12 Brushing with pediatric brush
- Q2 to Q4 hour swabbing with half strength peroxide
- Use of muco solvents like sodium bicarbonate
- Moisturize the oral cavity
“Antiseptic oral rinses (chlorhexidine, cetylpyridinium chloride [CPC], added after brushing or done in conjunction with comprehensive oral care did achieve elimination of VAP”
“Oropharyngeal colonization as well as colonization of dental plaque have been identified as risk factors for VAP as there is high concordance between the bacteria isolated from the oropharyngeal cavity or the dental plaque and those recovered from tracheal aspirates.”
Comprehensive Oral Care Interventions

“Strategies to prevent VAP are likely to be successful only if based upon a sound understanding of pathogenesis and epidemiology. The major route for acquiring endemic VAP is oropharyngeal colonization by endogenous flora or by pathogens acquired exogenously from the intensive care unit environment, especially the hands or apparel of health-care workers, contaminated equipment, hospital water, or air. The stomach represents a potential site of secondary colonization and reservoir of nosocomial gram-negative bacilli.”

Dental Plaque as a Bacterial Source of VAP

- Study on dental plaque colonization and ICU nosocomial infs.
- 57 patients studied
- Results:
  - Dental plaque occurred in 40% of pts.
  - Colonization of dental plaque was highly predictive of nosocomial infection
  - Salivary, dental, and tracheal aspirates cultures were closely linked

Reducing VAP Through Advanced Oral-Dental Care: A 48-Month Study

• Objective
  – Determine the effectiveness of comprehensive oral and dental care system and protocol on the rate of VAP

Reducing VAP Through Advanced Oral-Dental Care: A 48-Month Study

- **Method**
  - 2, 24 month periods
  - 779 and 759 patients
  - Q4 hour oral care
  - Study period introduced use of specific tools for teeth cleaning, deep oral suction, and oral tissue care
Suction Catheter

Policy: Every 4 hrs. or as needed

*the device manufacturer does not market or approve of its use below the vocal cords
Toothbrush with Sodium Bicarbonate

Policy: 2 X per day
Suction Swab with Moisturizer

Policy: Every 6 hrs.
Protocol Compliance

- Daily assessment
- Deep suctioning q4h
- Tooth brushing 2xd
- Oral tissue cleansing q6h
- Kits at bedside
- 2-line connector used
Feeling fuzzy???

Photographs courtesy of D. Ryan
Reducing VAP Through Advanced Oral-Dental Care: A 48-Month Study

• Results
  – 33% reduction in VAP
  – 12 per 1000 vent days prior to intervention
  – 8 per 1000 vent days during intervention
  – Confirmation period had 2 quarters of 0 VAPs
  – Duration of vent from 7.2 to 5.1
  – Length of stay from 8.7 to 6.4
Evidence to Support Brushing in the Critically Ill

- Tooth brushing as critical care intervention
- Review of 8 studies focused on the topic
- 5 of 8 had positive outcome with brushing
- Call for further research to explore the practice
### Evidence to Support Brushing in the Critically Ill

#### Table: Summary of clinical trials about patients using tooth brushing as an intervention

<table>
<thead>
<tr>
<th>Source</th>
<th>Type of Trial</th>
<th>Sample</th>
<th>Method/Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morris et al. 2009</td>
<td>Randomized controlled trial</td>
<td>471 patients receiving mechanical ventilation; 3 critical care units: medical, surgical, trauma, neuroscience</td>
<td>Patients receiving mechanical ventilation were randomized to 4 groups: (1) usual care; (2) tooth brushing 3 times a day; (3) chlorhexidine (0.12%); (4) chlorhexidine and tooth brushing. Chlorhexidine was significant in reducing the incidence of ventilator-associated pneumonia as measured by the Clinical Pulmonary Infection Score on day 8. No other intervention was significant.</td>
</tr>
<tr>
<td>Pedvania, et al. 2009</td>
<td>Randomized controlled trial</td>
<td>36 children in a pediatric intensive care unit</td>
<td>Children who were receiving mechanical ventilation were randomized into 3 groups: (1) oral care with brushing teeth; (2) tophix and platinol gel applied and (3) experimental group included oral care with brushing teeth and tongue and oral chlorhexidine gel treatment. Oral care was provided twice a day. Outcome measures demonstrated no difference in bacteria, duration of mechanical ventilation, or length of stay in the unit. No children received mechanical ventilation for less than 24 hours.</td>
</tr>
<tr>
<td>Pyle et al. 2009</td>
<td>Randomized controlled trial</td>
<td>147 patients receiving mechanical ventilation; medical-surgical intensive care unit</td>
<td>Patients receiving mechanical ventilation were randomized to 2 groups: (1) standard oral care every 8 hours that was applied to teeth, tongue, and mucosal surfaces with 0.12% chlorhexidine gluconate and 10 ml of chlorhexidine injected intratracheally and supraglottic and (2) tooth brushing group had standard oral care prior to tooth brushing with chlorhexidine as described. Brushed teeth and gums every 4 hours. Outcome measures demonstrated no difference in microbiological documented rates of ventilator-associated pneumonia, mortality, antibiotic-days, length of stay in the intensive care unit, or duration of mechanical ventilation.</td>
</tr>
<tr>
<td>Mun et al. 2009</td>
<td>Case-control</td>
<td>1486 adults receiving mechanical ventilation; medical-surgical unit</td>
<td>Study compared 2 groups: (1) historical controls (n=458) who received no systemic oral care and (2) intervention group (n=1028) that received oral care 3 times a day. A written protocol directed oral care that included tooth brushing and rinses with povidone-iodine 3 times a day. Results showed decreased incidence of ventilator-associated pneumonia in the oral care group. The relative risk of ventilator-associated pneumonia was decreased in the oral care group.</td>
</tr>
<tr>
<td>Garcia et al. 2009</td>
<td>Pre/Post intervention observational study</td>
<td>1538 adults receiving mechanical ventilation; medical intensive care unit</td>
<td>Study compared 2 groups: (1) controls (n=779) in a unit that had no oral procedures for preventing ventilator-associated pneumonia (e.g., oral assessments, suctioning of subglottic space, or tooth brushing) and (2) intervention period including oral care techniques for prevention (n=759) in the same unit. Oral care consisted of oral assessment, deep suctioning every 6 hours, oral cleaning every 6 hours and tooth brushing twice a day. Rates of ventilator-associated pneumonia decreased from 12.7% to 8.3% per 1000 ventilator days. Mortality and length of stay in the intensive care unit decreased in the group measured after institution of oral protocols.</td>
</tr>
</tbody>
</table>
Compliance in the Outcomes

- **September 2009 AJIC**
  - 80% compliance leads to drop in VAPs

- **November 2009 AJCC**
  - 85% compliance leads to drop in VAPs, Length of Stay in ICU and Time on the vent.
<table>
<thead>
<tr>
<th>Issue</th>
<th>SHEA/IDSA 2008</th>
<th>HICPAC 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring for Continued Need</strong></td>
<td>• Evidence of daily documentation on the patient’s chart, bedside paperwork, or electronic medical record of a sedation interruption and readiness to wean should be present unless clinically contraindicated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Perform assessments at regular intervals (e.g., 1 set of measurements per week)</td>
<td></td>
</tr>
</tbody>
</table>
Institute Active Weaning

- Duration, duration, duration!!


- Evidence-Based Guidelines for Weaning and Discontinuing Ventilatory Support. A Collective Task Force comprised of members of the American College of Chest Physicians, the American Association for Respiratory Care and the American College of Critical Care Medicine. *Chest* 2001;120:375S-395S.

Cost of Mechanical Ventilation

- Retrospective, cohort study designed to examine costs associated with mechanical ventilation
- Data from 253 hospitals, 51,009 pts.
- Mean cost with vent = $31,574
- Mean cost without vent = $12,931
- Incremental cost of mech. vent per day = $1,552

<table>
<thead>
<tr>
<th>Issue</th>
<th>SHEA/IDSA 2008</th>
<th>HICPAC 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disinfection of Equipment</td>
<td>• Implement policies and procedures for disinfection, sterilization, and maintenance of respiratory equipment that are aligned with evidence-based standards. (A-II)</td>
<td>• Thoroughly clean all equipment and devices to be sterilized or Disinfected. Category IA</td>
</tr>
<tr>
<td></td>
<td>• Whenever possible, use steam sterilization (by autoclaving) or high-level disinfection by wet heat pasteurization at &gt;158°F (&gt;70°C) for 30 minutes for reprocessing semicritical equipment or devices (i.e., items that come into direct or indirect contact with mucous membranes of the lower respiratory tract) that are not sensitive to heat and moisture. Use low-temperature sterilization methods (as approved by the Office of Device Evaluation, Center for Devices and Radiologic Health, FDA) for equipment or devices that are heat- or moisture-sensitive. Category IA</td>
<td></td>
</tr>
</tbody>
</table>
Know the Technology & Keep it Clean
THANK YOU!

Robert Garcia, BS, MT(ASCP), CIC
Infection Control Preventionist
rgarciaicp@aol.com
Cell 516.810.3093