The “Quat Absorption Issue”

The Concern

- To achieve disinfection the appropriate level of disinfectant must be applied to surfaces.
- Current programs often do not control critical inputs and combine improper products, tools and processes to deliver necessary disinfectant levels.
Understanding Quat Absorption

Quaternary ammonium compounds are cationic surfactants and attracted to fabric surfaces which are anionic:

Cloth – negatively charged

Concentration of Available Quat is Reduced

Quat Molecules – positively charged
Understanding Quat Absorption

Several factors affect quat absorption, including the following:

- Concentration of disinfectant
- Volume of disinfectant solution per wipe or mop
- Fabric type
- Time spent in disinfectant solution

#1
Quat disinfectant
½ oz per gallon

#2
Cotton wipe placed in disinfectant

#3
Cotton wipe placed in disinfectant
10 minutes soak

#4
Cotton wipe taken out of solution and wrung out
Quat concentration continues to drop in the rag during dip method.

Allowing rags to soak allows for consistent concentration after acclimation.
Volume of Disinfectant

String Mop-Conventional

- .5oz/Cotton/3gal
- .5oz/Cotton/2gal
- .5oz/Cotton/1gal
Concentration of Disinfectant

Quat Absorption

- Concentration of Disinfectant
- Quat Absorption
- Minutes Soak
- ppm quat

Graph showing the concentration of Quat over time, with different concentrations and minutes soak.
New Technologies and Processes
Chemicals and Biologics

- Residual chemistries
  - Silver
  - Copper-EPA registered, 2008
- “Green” disinfectants?
  - No Green Seal approval
  - Look for products of degradation, sustainable packages
- UV
  - UV is electromagnetic radiation with wavelength shorter than visible light
  - Vegetative bacteria-15 minutes/Spores-50 minutes
  - Does not eliminate cleaning step
- Hydrogen Peroxide Vapor
  - Technologies use microcondensation or dry mist forms of HPV
  - Several studies published
  - Does not eliminate cleaning step
- Phage
  - Target bacteria of concern

www.sterilizationanddisinfection.org
Microfiber Tools

- **Improved Cleaning Performance**
  - Large surface area
  - Physical characteristics

- **Reduction in chemical usage**
  - Pre-saturation
  - Improved efficiency

- **Prevention of cross-contamination**
  - Color coding
  - No re-dipping in bucket
Process Controls

- **Lean Six Sigma**
  - Sustainability savings
  - Process efficiency
  - Process simplification and standardization

- **HAACP**
  - Controlling critical process inputs ensures consistent, desired outcomes

- **Best Practices**
  - AHE, CDC, APIC, JC

- **Objective Outcome Monitoring**

  Standardizing Processes to Align With Best Practices
  Process Controls Yield Superior Cleaning Outcomes
Best Practices – Pilot Studies
Room Hygiene Program Overview

Continuous Improvement & Education

BRAND PROTECTION

INCREASED SATISFACTION

HAI RISK REDUCTION

Outcomes Data Analysis & Reporting

Process Optimization

Drive Continuous Improvement
Learning Management
Staff Certification
Process Controls
Standard Operating Procedures

Clinical Products & Tools
Verified Accuracy
HACCP
Best Practices
Statistical Process Controls
Lean Six Sigma
Sustainable Solutions

Auditing
Trending/Benchmarking
Objective Metrics
Cleanliness
Satisfaction
Behavior
Knowledge
Efficiencies
Qualitative Data
Pilot Study Overview

- **Collect Baseline Data**
- **Provide an Intervention**
  - Continuous improvement program using data to drive on-going enhancements
  - Clinically validated combination of Dispenser, Product and Tools
  - Hands-on multiple day program implementation
  - Staff certification program (Supervisors and Staff)
  - Data collected through regularly scheduled audits
    - Audits performed over multiple days/shifts
  - On-going staff education program driven by audit findings
    - Personally delivered by clinical educator
- **Measure Results and Acceptability**
  - Does the intervention make a difference?
  - Are best practices sustained?
  - Are there any other benefits?
Process Optimization

- Clinical Products & Tools
- Verified Accuracy
- HACCP
- Best Practices
- Statistical Process Controls
- Lean Six Sigma
- Sustainable Solutions
Clinical Products and Tools
Designed for Clinical, Acute Care Setting

- **Clinical Products**
  - Products designed in combination with tools to deliver consistent, proven outcomes

- **Clinical Tools**
  - **Microfiber**
    - Color-coordinated cloths and mops
    - Ensure the appropriate amount of disinfectant is delivered
    - Eliminate cross-contamination
    - Improved efficiency
  - **Carts**
    - Separation of “Clean” and “Dirty”
    - Color coordination to reinforce best practices
    - Optimized efficiency
    - Improved ergonomics
Improvements in Reliability & Accuracy

- Current programs not designed and monitored for healthcare needs (reliability and accuracy)

- Improvements
  - Highly reliable and accurate dispensing system
    - Verified through quarterly service visits
  - Microfiber – validated accuracy with Ecolab Quat
    - “Evaluation of Quat Absorption” – Poster for APIC 2009
  - Process optimization tools
    - Help ensure amount of disinfectant and cloths/mops
Control Quat Absorption

Factors impact quat absorption:
- Concentration of disinfectant
- Volume of disinfectant per cleaning cloth
- Fabric type
- Time spent in disinfectant solution

Best Practices ensure:
- Accurate disinfectant concentration
- Correct volume of disinfectant dispensed
- Mixed with appropriate number of microfiber cloths
- Assurance that quat level has acclimated to deliver full disinfectant activity to surfaces
Best Practice Processes

Drive Consistency & Efficiency

- Designed on technical/clinical foundation
- Following HACCP Principles
- Validated to achieve consistent outcomes
- Designed to improve staff safety and efficiency
Outcomes, Data Analysis and Reporting

- Auditing
- Trending/Benchmarking
- Objective Metrics
- Cleanliness
- Satisfaction
- Behavior
- Knowledge
- Efficiencies
- Qualitative Data
Audit Overview

2-3 Day Quarterly Onsite Room Hygiene Assessment

- Room cleanliness monitoring (fluorescent marking solution and culture)
- Documented behavioral and other observations (pictures & interviews)
- ES and Nursing satisfaction surveys
- ES knowledge assessment (training records)
- Workflow analysis (including efficiency and ergonomics)
- Documentation and review of staff training records
- Dispenser analysis (dilution accuracy report)
- Products and tools analysis
Audit Overview

Findings Critical to Program Success

- Audit findings critical for successful program implementation
- Provide benchmark for future improvements
- Drive continuous improvement of key metrics
  - Audit findings direct quarterly education
High Touch Object Cleaning Verification

Key Data Collected

- **Fluorescing Gel**
  - Clear marker applied to HTOs after patient discharged, before cleaning
  - Marker reviewed by auditor with black light after cleaning

- **Total Aerobic Bacteria Count**
  - Pre-cleaning culture taken of HTOs
  - Post-cleaning cultures taken to ensure appropriate cleaning and reduction of organisms
Behavioral Observations

Monitoring Critical to Effectively Manage & Correct

- Gathering examples helps reinforce key program messages
- Can provide immediate corrective action and use later as training example for others
- Pictures and interviews help reinforce training
Outcome Data

Benefits of Consistent Data Collection

**Benchmarking**
- Versus pre-program implementation
- Across Health System or GPO

**Trending**
- Continuous data collection allows trending
- Early detection of potential issues
- Measurement of direct impact of program

**Objective data**
- True performance assessment

**Drive continuous improvement**
- Regular assessments provide opportunity to immediately address issues
Continuous Improvement and Education

Drive Continuous Improvement
Learning Management
Staff Certification
Process Controls
Standard Operating Procedures
Adult Learning and Behavioral Change

- Blended delivery approach
- Icon based tools
- Uses technology-enhanced learning tools
- Reinforced with ongoing coaching methods that ensure results are sustained

**LEARN**: Content personally delivered

**PRACTICE**: Learner works on new content with guidance & direction

**DO**: Learner applies new content and demonstrates proficiency
HIGH TOUCH OBJECTS

PATIENT ROOM

Room Inner Door Knob  Room Light Switch  Bed Rail/Controls  Call Button  Telephone

Bedside Table Handle  Tray Table  Chair  Room Sink  IV Pole

ECOLAB®
Everywhere It Matters.
Pilot Results
Evaluation of a Programmatic Approach to Improving Patient Room Cleaning Outcomes

Emily McCracken, MPH, Director Infection Prevention and OI, Hamot Health System, Erie, PA
Kevin Martin, RN, BSN, HLN, CIC, Director of Infection Control/Epidemiology and Environmental Services, Advocate Christ Medical Center, Oak Lawn, IL
Linda Homan, RN, CIC, Manager Clinical and Professional Services, Ecolab Inc., Saint Paul, MN

ISSUES:
Many patient rooms are not well cleaned, and there is increasing evidence that a programmatic approach to environmental hygiene can improve outcomes. Cleaning of high-touch objects is critical to prevent transmission of pathogens from the environment to the patients. Methods used to monitor and evaluate the effectiveness of environmental hygiene are often subjective.

PROJECT:
A pilot study was conducted at two sites, a 600-bed urban hospital and a 350-bed non-urban hospital, to evaluate the impact of a new programmatic approach on environmental hygiene (EH) practices, efficiency, sustainability and staff satisfaction. The program included the use of products, tools, processes, enhanced staff training and engagement, staff surveys, and objective EH monitoring tools such as fluorescent marking gel and environmental cultures to monitor effectiveness of cleaning. A pre- and post-intervention assessment of EH practices, efficiency, product usage and staff competency was conducted.

METHODS:
EH practice effectiveness was evaluated by measuring the percentage of high-touch objects (HTOs) cleaned as evidenced by the removal of a fluorescent gel mark that was applied to HTOs before discharge cleaning. If after Environmental Services (ES) staff performed discharge cleaning, the fluorescent gel mark was disturbed, it was documented as “pass” if the gel mark was not disturbed, it was documented as “fail.”

At Site A, in addition to gel marking, an environmental culture obtained from the same HTOs was used to measure total aerobic colony counts before and after cleaning, any value for culture colony forming units (CFU) that was above a 0 was considered a failure. Therefore, the culture was coded as either pass or fail.

For all gel and culture data collected, an attribute agreement analysis was performed in Excel. This analysis identified what percent of the results agreed, both gel and culture “pass” or “both fail” (where gel removal was pass and culture result was “fail”).

A best practices audit tool was employed to evaluate practices during direct observation.

Room turnover defined as the time the ES staff entered the patient room to the time that room cleaning was completed, was used as a measure of efficiency.

Dispenser accuracy was evaluated by measuring disinfectant concentration parts per million (PPM) in dispersed use solution.

Pre- and post-intervention chemical and water consumption was used to measure sustainability.

The effectiveness of classroom and hands-on training on EH best practices was measured using a 10-question staff competency exam.

RESULTS:
Environmental hygiene practices, as measured by percent pass in disturbance of a fluorescent marking gel on high-touch objects at Site A and Site B, was 83.3% and 83.3%, respectively. Pre-intervention EH practice effectiveness was 55.7% and 79.4% at Site A and Site B, respectively (see Table 1).

Table 1. Environmental hygiene practices, as measured by percent pass in disturbance of a fluorescent marking gel on high-touch surfaces pre- and post-intervention.

<table>
<thead>
<tr>
<th>Site</th>
<th># of HTOs marked Pre-Intervention</th>
<th>% Pass Pre-Intervention</th>
<th># of HTOs marked Post-Intervention</th>
<th>% Pass Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A</td>
<td>360</td>
<td>83.3%</td>
<td>360</td>
<td>83.3%</td>
</tr>
<tr>
<td>Site B</td>
<td>464</td>
<td>79.4%</td>
<td>1063</td>
<td>83.3%</td>
</tr>
</tbody>
</table>

There was a higher correlation between gel disturbance “pass” and 0 CFU “pass” after implementing a multi-modal environmental hygiene program at Site A. (See Table 2).

Table 2. Percent agreement between gel disturbance and 0 CFU, Site A.

<table>
<thead>
<tr>
<th>Period</th>
<th># of HTOs</th>
<th>% Agreement between “pass” gel and 0 CFU “pass”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td>168</td>
<td>60.1%</td>
</tr>
<tr>
<td>Post-intervention</td>
<td>295</td>
<td>78.4%</td>
</tr>
</tbody>
</table>

LESSONS LEARNED:
Use of a programmatic approach incorporating products, tools and processes, enhanced staff training and engagement, staff surveys, and objective environmental hygiene monitoring tools can improve environmental hygiene practices, efficiency, sustainability and staff satisfaction. Fluorescent marking gel is a surrogate marker for bacterial contamination in patient rooms when used as part of a comprehensive environmental hygiene program.

REFERENCES:

Author/Financial Disclosures: Linda Homan is an employee of Ecolab, Inc.
Table 1. Environmental hygiene practices, as measured by percent pass in disturbance of a fluorescent marking gel on high touch surfaces pre- and post-intervention

<table>
<thead>
<tr>
<th>Site</th>
<th># HTO's marked Pre- Intervention</th>
<th>% Pass Pre-intervention</th>
<th># HTO's marked Post- Intervention</th>
<th>% Pass Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A</td>
<td>564</td>
<td>55.7%</td>
<td>360</td>
<td>85.3%</td>
</tr>
<tr>
<td>Site B</td>
<td>464</td>
<td>78.4%</td>
<td>1063</td>
<td>83.1%</td>
</tr>
</tbody>
</table>
Table 2. Percent agreement between gel disturbance and 0 cfu culture, Site A.

<table>
<thead>
<tr>
<th>Period</th>
<th># of HTOs</th>
<th>% Agreement between “pass” gel &amp; 0 cfu “pass” culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td>168</td>
<td>60.1%</td>
</tr>
<tr>
<td>Post-intervention</td>
<td>295</td>
<td>78.6%</td>
</tr>
</tbody>
</table>
# Pilot Summary - Outcomes

<table>
<thead>
<tr>
<th>Metric</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Site 4</th>
<th>Site 5</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cleaning Outcomes - DAZO</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>58%</td>
<td>69%</td>
<td>72%</td>
<td>59%</td>
<td>66%</td>
<td>65%</td>
</tr>
<tr>
<td>Ecolab Program</td>
<td>86%</td>
<td>83%</td>
<td>85%</td>
<td>85%</td>
<td>88%</td>
<td>85%</td>
</tr>
<tr>
<td>% Improvement</td>
<td>48%</td>
<td>20%</td>
<td>18%</td>
<td>44%</td>
<td>33%</td>
<td><strong>32%</strong></td>
</tr>
<tr>
<td><strong>Cleaning Outcomes - Cultures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>42%</td>
<td>71%</td>
<td>54%</td>
<td>62%</td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td>Ecolab Program</td>
<td>69%</td>
<td>80%</td>
<td>87%</td>
<td>95%</td>
<td></td>
<td><strong>83%</strong></td>
</tr>
<tr>
<td>% Improvement</td>
<td>64%</td>
<td>13%</td>
<td>61%</td>
<td>53%</td>
<td></td>
<td><strong>45%</strong></td>
</tr>
<tr>
<td><strong>Room Turnover Efficiency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline (minutes)</td>
<td>24</td>
<td>24</td>
<td>51</td>
<td>45</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Ecolab Program (minutes)</td>
<td>24</td>
<td>18</td>
<td>45</td>
<td>34</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>% Improvement</td>
<td>-2%</td>
<td>26%</td>
<td>11%</td>
<td>24%</td>
<td></td>
<td><strong>15%</strong></td>
</tr>
</tbody>
</table>
# Data Driven Continuous Improvement

## Heat Map: Progress and Trend Report

<table>
<thead>
<tr>
<th>Percent of High Touch Objects Cleaned</th>
<th>N= 1015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Period n = 561</td>
</tr>
</tbody>
</table>

### Percent of High Touch Objects Cleaned

<table>
<thead>
<tr>
<th>High Touch Object</th>
<th>Baseline</th>
<th>Q1 2011</th>
<th>Q2 2011</th>
<th>Net</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Rail/Controls</td>
<td>20%</td>
<td>64%</td>
<td>76%</td>
<td>55.8%</td>
<td>▲</td>
</tr>
<tr>
<td>Bedside Table Handle</td>
<td>60%</td>
<td>59%</td>
<td>52%</td>
<td>-8.5%</td>
<td>▼</td>
</tr>
<tr>
<td>Call Button</td>
<td>30%</td>
<td>68%</td>
<td>70%</td>
<td>39.7%</td>
<td>▲</td>
</tr>
<tr>
<td>Chair</td>
<td>60%</td>
<td>55%</td>
<td>97%</td>
<td>37.0%</td>
<td>▲</td>
</tr>
<tr>
<td>IV Pole (Grab Area)</td>
<td>0%</td>
<td>100%</td>
<td>79%</td>
<td>78.8%</td>
<td>▼</td>
</tr>
<tr>
<td>Room Inner Door Knob</td>
<td>10%</td>
<td>73%</td>
<td>58%</td>
<td>47.6%</td>
<td>▼</td>
</tr>
<tr>
<td>Room Light Switch</td>
<td>0%</td>
<td>54%</td>
<td>64%</td>
<td>63.6%</td>
<td>▲</td>
</tr>
<tr>
<td>Room Sink</td>
<td>0%</td>
<td>69%</td>
<td>94%</td>
<td>93.9%</td>
<td>▲</td>
</tr>
<tr>
<td>Telephone</td>
<td>50%</td>
<td>95%</td>
<td>70%</td>
<td>19.7%</td>
<td>▼</td>
</tr>
<tr>
<td>Tray Table</td>
<td>60%</td>
<td>82%</td>
<td>55%</td>
<td>-5.5%</td>
<td>▼</td>
</tr>
<tr>
<td>Bathroom Handrail by Toilet</td>
<td>40%</td>
<td>73%</td>
<td>79%</td>
<td>38.8%</td>
<td>▲</td>
</tr>
<tr>
<td>Bathroom Inner Door Knob</td>
<td>13%</td>
<td>89%</td>
<td>94%</td>
<td>81.4%</td>
<td>▲</td>
</tr>
<tr>
<td>Bathroom Light Switch</td>
<td>13%</td>
<td>80%</td>
<td>94%</td>
<td>81.4%</td>
<td>▲</td>
</tr>
<tr>
<td>Bathroom Sink</td>
<td>20%</td>
<td>59%</td>
<td>73%</td>
<td>52.7%</td>
<td>▲</td>
</tr>
<tr>
<td>Toilet Bedpan Cleaner</td>
<td>50%</td>
<td>79%</td>
<td>52%</td>
<td>1.5%</td>
<td>▼</td>
</tr>
<tr>
<td>Toilet Flush Handle</td>
<td>50%</td>
<td>86%</td>
<td>82%</td>
<td>31.8%</td>
<td>▼</td>
</tr>
<tr>
<td>Toilet Seat</td>
<td>80%</td>
<td>95%</td>
<td>94%</td>
<td>13.9%</td>
<td>▼</td>
</tr>
<tr>
<td><strong>Total Patient Room</strong></td>
<td>41%</td>
<td>69%</td>
<td>71%</td>
<td>30.0%</td>
<td>▲</td>
</tr>
<tr>
<td><strong>Total Patient Bathroom</strong></td>
<td>39%</td>
<td>81%</td>
<td>81%</td>
<td>41.6%</td>
<td>▲</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>40%</td>
<td>74%</td>
<td>75%</td>
<td>34.9%</td>
<td>▲</td>
</tr>
</tbody>
</table>

### Notes

- **80-100%**: Green
- **70-79%**: Yellow
- **<70%**: Red

- Use data to identify cleaning deficiencies
- Data shows areas where not achieving targeted improvement
- Emphasize and reward improvement

---

*Emphasize* and reward improvement
Pilot Summary
What Did We Learn?

- Current environmental cleaning processes and tools are often inadequate
- Changing behavior takes right tools, time and reinforcement
  - Observation assists in determining where additional training is necessary
- Improvement opportunities exist in:
  - Cleaning outcomes
  - Staff knowledge and engagement
  - Data driven continuous improvement (collecting and using data to drive decisions)
  - Improved cleaning tools and processes designed for healthcare
Summary

- Latest Research
  - Role of the Environment
  - Latest Research
  - Monitoring the Environment
  - Quat Absorption
  - New Technologies and Programs

- Best Practices
  - Process Optimization
  - Objective Outcome Monitoring, Data Analysis and Reporting
  - Continuous Improvement, Reporting and Documentation
Questions?

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