Should We Try To Prevent Healthcare-Associated MRSA & VRE Infections?
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Why Control Nosocomial MRSA?

- MRSA doesn’t just replace MSSA in an ecologic niche, but adds to total burden of illness.  
- MRSA colonization has been associated with a higher infection rate than MSSA.  
- MRSA infection is significantly more deadly than MSSA infection.  
- MRSA infection is significantly more costly than MSSA infection.  
- Virtually all patients with MRSA infection have to acquire it by spread.  
- Isolation works as documented in > 45 epidemiologic studies (i.e., MRSA infection preventable).  

Why Control Nosocomial VRE?

- VRE infection is significantly more deadly than VSE infection.  
- VRE infection is significantly more costly than VSE infection.  
- Virtually all patients with VRE infection have to acquire it by spread.  
- Isolation works as documented in > 25 epidemiologic studies (i.e., VSE infection preventable).  
- Allowing high rates of spread of vancomycin resistance genes will increase the probability of both creation and spread of VRSA.  
- VISA strains significantly more deadly than MRSA.
Higher mortality with MRSA vs MSSA BSI (OR=1.9, 95% CI, 1.5-2.4, p < 0.001) after adjustment for severity of illness.1

Adjusted attributable mortality 23.4% for MRSA BSI vs only 1.3% for MSSA BSI.2

Higher mortality with MRSA vs MSSA SSI (adjusted odds ratio, 3.4; 95% confidence interval, 1.5-7.2).3

1Cosgrove SE. CID 2003; 36:53-59.

Outcomes Associated With Vancomycin-resistant Enterococci: a Meta-analysis

In 13 studies, pooled VRE bacteremia case-fatality rates were significantly higher than for VSE (48.9% vs 19%; RR, 2.57; CI95, 2.27 to 2.91; attributable mortality = 30%). In 5 studies when bacteremia was the direct cause of death, VRE was more deadly than VSE (39.1% vs 21.8%; RR, 1.79; CI95, 1.28 to 2.5; attributable mortality = 17%). Four multivariate analyses found significant increases in case-fatality rates (OR, 2.10 to 4.0), 3 showed trends toward increase (OR, 1.74 to 3.34 with wide confidence intervals), and 3 with low statistical power found no difference. VRE BSI recurred in 16.9% versus 3.7% with VSE (P < .0001). Three studies reported significant increases in LOS, costs, or both with VRE.

Salgado, CD. ICHE 2003;24:690-698.

Attributable Mortality of VRE Bacteremia

Association with death was 2.52-fold higher for VRE bloodstream infections than for VSE BSI (95% CI= 1.9-3.1, p < 0.001) after adjustment for severity of illness in a meta-analysis of 9 studies providing data allowing adjustment for severity of underlying illness. A second meta-analysis excluded studies of selected populations and found similar results in the 7 remaining studies (OR=2.32, 95% CI=1.7-2.96).

Diazgranados CA et al. IDSA 2003; abstract 491, p. 45.
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Attributable Mortality Of VRE Infection

- VRE infection associated with significant increases in attributable adjusted mortality (OR=2.5, p=0.05) as compared with patients with infection due to vancomycin susceptible enterococci.

Kaye KS et al, ICAAC 2002 http://www.asm.org

Epidemiological and Microbiological Characterization of Infections Caused by Staphylococcus Aureus With Reduced Susceptibility to Vancomycin, United States, 1997-2001

VISA infected patients were more likely to die than patients with MRSA infections with full susceptibility to vancomycin in a case-control analysis.

This remained true in stepwise, multiple logistic regression after adjustment for other known predictors of hospital death.


Infection With Vancomycin-Resistant Staphylococcus Aureus Containing The Vana Resistance Gene

PFGE showed that patient’s VRSA was identical to patient’s MRSA strain that was susceptible to vancomycin and to an MRSA isolate from her friend. PCR revealed only \textit{van}\textsubscript{A} and sequencing showed that the \textit{van}\textsubscript{A} in the VRSA was identical to the \textit{van}\textsubscript{A} in patient’s VRE, which was also identical to the \textit{van}\textsubscript{A} sequence in transposon Tn1546. The VRSA isolate’s MIC for vancomycin was 1024. The authors conclude that “this finding underscores the importance of extending efforts to prevent and reduce the spread of MRSA.”

Excess Cost of MRSA Infection

MRSA infections cost significantly more than MSSA infections.

Kaye KS et al, ICAAC 2002 http://www.asm.org
Abramson, ICHE 1999;20:408.

Costs Of VRE Bacteremia

• VRE bacteremia associated with significant increases in length of stay (p=0.004), and hospital costs (more than $27,000 per episode, p=0.04) as compared with VSE bacteremias.1
• VRE BSI associated with 19-day increase in length of stay (p<0.001), and increased hospital costs ($79,589 per episode, p<0.001) as compared with matched, uninfected controls.2


Mechanisms Of Developing Antibiotic Resistance

1. Random genetic mutation.
2. Plasmid swapping during conjugation.
3. Movement of transposons to plasmids/chromosomes.
4. Transduction by bacteriophages.
5. Transformation (acquisition of resistant genes from a recently killed cell and incorporation into a chromosome or plasmid).
6. Binary fission (replication) can share any of the above.
Mechanisms Of Developing Antibiotic Resistance

Natural Selection


Prevalence of Antibiotic Therapy in U.S. Hospitals In Recent Surveys

- A quarter to a half of all patients
- Almost all ICU patients

Clonal Spread Of Methicillin-Resistant Staphylococcus Aureus In A Large Geographic Area Of The United States

MRSA isolates mostly from blood were studied from 12 hospitals in 7 states. Using different molecular techniques for MRSA typing, we verified that two unique epidemic clones are spread over a large geographic area in the US (51% were clone A, 9% strains closely related to A, and 20% clone W). Clone A infected patients in all 12 hospitals accounting for 17-78% of all MRSA infections in the 12 hospitals. Clone W caused infections in 10 of the 12 hospitals. In addition, we showed that a previously described MRSA clone type, the New York clone (I::A::A), is widely spread beyond the New York frontiers.


Possible Control Measures

1) Antibiotic control
2) Prevention of spread
   a) hand hygiene for all patient contacts (Universal/Standard Precautions)
   b) identify colonized patients with active surveillance cultures and use barrier precautions to prevent spread
Risk of Acquiring MRSA from an MRSA Colonized Roommate

- Patients with an MRSA-positive roommate were significantly more likely to be found positive for MRSA as compared with other high-risk hospital patients without known exposure to an MRSA-positive roommate.
  - 8.1% vs. 4.7%, RR=1.73 (95% CI 1.02-2.94, p=0.042)
  - The entire group of exposed patients were hospitalized a mean of 6.7 days before their follow-up culture.
  - The control “high-risk” patients had been hospitalized for a mean of 6.8 days before their follow-up culture.


<table>
<thead>
<tr>
<th>AB type (percent of time it occurs among all MRSA)</th>
<th>Roommate pairs with the AB</th>
<th>Probability of occurring by chance alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>R to CC,Cip,E (38.8%)</td>
<td>6</td>
<td>3.41 x 10^-3</td>
</tr>
<tr>
<td>R to Cip,E (22.8%)</td>
<td>1</td>
<td>2.28 x 10^-1</td>
</tr>
<tr>
<td>R to CC,Cip,E,STX (15.3%)</td>
<td>2</td>
<td>2.34 x 10^-2</td>
</tr>
<tr>
<td>R to CC,Cip,E,STX,Tet (3.5%)</td>
<td>1</td>
<td>3.50 x 10^-2</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>6.37 x 10^-7</td>
</tr>
</tbody>
</table>

AB=antibiogram, R=resistant, CC=clindamycin, Cip=ciprofloxacin, E=erythromycin, STX=sulfamethoxazole, Tet=tetracycline
Quinolone Exposure Preferentially Selects for MRSA Carriage.

MRSA Control Via Antibiotic Control
4 studies have reported decreased MRSA following reductions in usage of certain antibiotics, but in three new measures to block spread were simultaneously implemented:
1) switching from a third to a first generation cephalosporin for perioperative prophylaxis; 2) major reductions in the use of third generation cephalosporins and clindamycin; 3) restriction of both ceftazidime and ciprofloxacin as well as cycling of other beta-lactams; 4) MRSA declined in the first year of an antibiotic control program but then rose again despite continuation of the program.

Failure To Prevent MRSA Spread
Thompson et al. found that despite isolation of patients known to have MRSA from clinical cultures, the prevalence of MRSA infection continued to increase.

<table>
<thead>
<tr>
<th></th>
<th>1977</th>
<th>1979</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>0%</td>
<td>19%</td>
<td>24%</td>
</tr>
<tr>
<td>Blood stream Infection</td>
<td>0%</td>
<td>13%</td>
<td>40%</td>
</tr>
<tr>
<td>Surgical site Infection</td>
<td>0%</td>
<td>27%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Control of MRSA Using Active Surveillance Cultures and Isolation of Colonized Patients

MRSA (which had been out of control for 2.5 years) Was Completely Eradicated from the Hospital

Within 1.5 years

This was done with no antibiotic control effort of any kind.

There was also no campaign to increase hand hygiene.

Reservoir for the Spread of Antibiotic Resistant Pathogens

Recognized by results of Clinical Microbiology Cultures

Colonized Patients

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A Webber Training Teleclass  www.webbertraining.com
Sensitivity of Using Clinical Microbiology Cultures To Detect MRSA-Colonized Hospital Patients

- Of 437 patients found to be colonized with MRSA on hospital admission, 66 had positive clinical microbiology cultures for MRSA during the hospital stay (15%, 95% CI 11.9-18.8%).

- 306 (70%) had 1,238 clinical microbiology cultures done during their admission and 98 (7.9%, 95% CI 6.5-9.6%) were positive for MRSA.


VRE and MRSA Bacteremias at Hospitals of Comparable Size and Complexity, 1999


Rates of MRSA Transmission

<table>
<thead>
<tr>
<th>Source</th>
<th>Isolated</th>
<th>Unisolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmissions</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Patient-days</td>
<td>558</td>
<td>71.5</td>
</tr>
<tr>
<td>Rates</td>
<td>0.009</td>
<td>0.140</td>
</tr>
</tbody>
</table>

RR=15.6, 95% CI=5.3-45.6, p<0.0001

Follow-up After Control of MRSA Outbreak in NICU

No MRSA in any patient during the next 10 years and about 100,000 patient-days.

This long term control suggests a low frequency of de novo development of methicillin resistance despite prolonged hospital stay and frequent antibiotic therapy in the NICU.

It also suggests a very low rate of MRSA colonization among healthcare workers and mothers in central Virginia.

Risk of MRSA Transmission from Unisolated, MRSA-Colonized NICU Patients Using Standard Precautions

<table>
<thead>
<tr>
<th>Source</th>
<th>Unisolated</th>
<th>Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmissions</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Patient-days</td>
<td>58.5</td>
<td>497</td>
</tr>
<tr>
<td>Rates</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>RR</td>
<td>11.9, 95% CI = 3.25-47.5, p = 1.4 x 10^-4</td>
<td></td>
</tr>
</tbody>
</table>

Geffers C et al. Unpublished data

Rates of Clonal MRSA Transmission

<table>
<thead>
<tr>
<th></th>
<th>Unisolated</th>
<th>Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmissions</td>
<td>38 *</td>
<td>1 ^</td>
</tr>
<tr>
<td>Assumed person days at risk</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

* = # acquiring MRSA clone from 3 unisolated ICU patients (i.e., 23 patients and 15 HCWs)
^ = # acquiring MRSA clone from 3 isolated ICU patients

RR = 38.0, 95% CI = 6.4-1539.9, p < 10^-6

Secondary infection with MRSA in Dutch hospitals, 1994-1996

231 hospitals had MRSA index cases and responded to survey, allowing 2-year retrospective cohort study.

Isolation cohort (for which index cases were isolated on hospital admission as per Dutch guidelines): 4 of 73 gave rise to secondary transmission to one or more.

Non-isolation cohort (patients not suspected and thus not put into isolation on admission): 19 of 95 gave rise to secondary transmission to one or more.

Odds ratio = 4.3 (95% CI = 1.3-18.2)


Incidence of Colonization Since Initiation of Active Surveillance

<table>
<thead>
<tr>
<th>0%</th>
<th>1%</th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
<th>5%</th>
<th>6%</th>
<th>7%</th>
<th>8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>123456789</td>
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<td></td>
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</tr>
</tbody>
</table>

4-week intervals

Percentage per 100 pts at risk


Results – MICU MRSA infection rates

- Isolating the large influx of MICU AMSC + patients and the newly acquired cases (WMSC +) resulted in an 83.7% reduction of MICU MRSA HAI – 3.53/1,000 PT days in 2001 vs 0.55 in 2003
- This was a significantly lower rate (OR 6.6 CI 2.2-22.3 p<0.001).

Blank MK et al, SHEA 2003 abstract 253 (updated)
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Criteria for Causal Inference
1. Strength of association
2. Consistency of evidence
3. Temporal relationship
4. Biological gradient
5. Reversibility
6. Specificity
7. Coherence of evidence


Studies Reporting Control of MRSA Using ASC & CP
Cantey J, et al. SHEA. 2002; Abstract 36:49.
Cooper CL et al, ICHE 2002;23:483-484.
Adverse Effects of Isolation in Unrandomized Study

MRSA isolation patients were twice as likely to have adverse events (31 vs. 15 per 1000 patient days, p<0.001). These prominently involved falls, pressure ulcers, and fluid/electrolyte disorders. Nurses recorded vital signs and physicians wrote progress notes less frequently. There were no significant increases in diagnostic, operative, anesthetic, medical procedure or adverse drug events nor in mortality. The authors said these findings would require confirmation from further studies in other populations.


51-Month MRSA NICU Outbreak

40-50% of all neonates colonized by outbreak strain of MRSA
75 MRSA bacteremias
14 (18.6%) with MRSA bacteremia died


Genome and Virulence Determinants of Virulent Community-acquired MRSA

The whole genome of MW2, a strain of community-acquired MRSA, was sequenced by shotgun cloning/sequencing. MW2 caused fatal septicaemia and septic arthritis in a 16-month-old girl in North Dakota, USA, in 1998. Nineteen additional virulence genes were recorded in the MW2 genome.

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MRSA Continues to Increase
NNIS Hospitals' MRSA Rates

Prevalence of MRSA Carriage Among the General Population
Two recent, large prevalence studies focusing on children, because of frequent reports of community acquired MRSA in children, both found a prevalence of 0.2%.1, 2 A third found a higher rate among homeless adults, but of those without healthcare contacts it was 0.2%.3

3Charlebois E et al, CID 2002; 34:425-33.

Prevalence of Methicillin-resistant Staphylococcus Aureus Nasal Carriage in the Community Pediatric Population
Nasal swabs were collected from 500 children at well-child visits in Nashville, TN. Cultures were plated onto selective staphylococcal media, with or without oxacillin. isolates were confirmed by coagulase tube testing. PFGE was used to evaluate epidemiologic relatedness. 4 patients (0.8%) had MRSA. Only having a household member employed in a hospital was associated with a greater risk of MRSA nasal carriage (odds ratio, 9.6; P= 0.008).

Spread of MRSA To Household Contacts of Individuals with Nosocomially-Acquired MRSA

MRSA was isolated from 25 (14.5%) of 172 individuals. Among the contacts to index cases who had at least one MRSA-colonized contact, those with close contact to the index case were 7.5 times more likely to be colonized (53% versus 8%, 95% CI 1.1-50.3, p=0.002). Analysis of antimicrobial susceptibility and DNA fingerprint patterns suggested person-to-person spread.

Calfee DP et al, ICHE 2003;24:422-426.

Nottingham Staphylococcus Aureus Population Study: Prevalence of MRSA Among Elderly People in the Community

The sample (1% of people ≥65) found nasal MSSA in 257 people (26.7%, 95% confidence interval 24.1% to 29.8%) and MRSA in 8 (0.8%, 0.3-14%). MRSA was associated with hospital admission in the prior six months (adjusted odds ratio 13.0, 2.5-68.2) and diabetes (6.8, 1.33 to 34.3). All MRSA isolates were the epidemic MRSA type 15 widely prevalent in English hospitals and also the most common MRSA strain in the two major hospitals in Nottingham at the time of investigation.


After CO-MRSA rates increased significantly in 2000, MRSA accounted for 34% of all CO-S. aureus infections.

128 (27.3%) of 469 participants had *Staphylococcus aureus*. Nine (2.1%) of 469 had MRSA carriage; of these, five had CA-MRSA (5/469, overall CA-MRSA carriage rate: 1.1%). MRSA carriage was associated with antimicrobial use in the previous year (RR 7.2, p=0.04) and residence in a household of >7 persons (RR 4.5, p=0.03).

Healthcare Spread of and Infections by mec IV MRSA Strains

Associated with community spread, these strains have also been associated with spread and virulent infections in the healthcare setting. They also can acquire additional co-resistances and can be difficult to separate from mec types I-III without DNA typing.

Tenover F. IDSA 2003

Fatal pneumonia in an adolescent due to community-acquired methicillin-resistant Staphylococcus aureus positive for Panton-Valentine-leukocidin

A 15-year-old girl developed a severe S. aureus pneumonia following influenza. The patient was admitted to a PICU but died despite aggressive therapy on the third day after admission with hypoxic-ischaemic encephalopathy. PCR-based methods demonstrated that the isolate possessed the Panton-Valentine-leukocidin (PVL) gene, an exotoxin associated with fulminant, necrotizing pneumonia.


Recent Recommendations on MRSA Infection Control

"Application of known prevention measures should be our highest priority. This should include active surveillance cultures and contact isolation in healthcare facilities. These measures have been documented to reduce or eliminate MRSA transmission in healthcare facilities and do not require advanced genotyping capacity to accomplish. It should be remembered that the majority of MRSA is healthcare-related, as the current prevalence of MRSA in the community population is <1%."

Effect Of Vancomycin and 3rd Generation Cephalosporins On VRE Rates In 126 ICUs

- Higher rates of vancomycin or third-generation cephalosporin use were associated with increased prevalence of VRE, independent of other ICU characteristics and the endemic VRE prevalence elsewhere in the hospital.
- Decreasing the use rates of these antimicrobial agents could reduce rates of VRE in ICUs.


VRE Control Via Antibiotic Control

1&2) 2 studies have reported that greatly reducing or stopping the use of ceftazidime and switching to pip-tazo was associated with a 2/3 relative reduction in VRE. Both made multiple changes at once, including new measures to prevent spread, making it hard to see the effect of each measure. 3) 3rd study suggested vanco restriction in ICUs was associated with a modest decline in VRE (7.5% decrease vs. 5.7% increase in ICUs not doing this over the 1.25-year study). 4) 4th study reported declines in C diff and VRE but not MRSA. 5) Another recent study reported that VRE continued to increase despite 85% relative reduction in the usage of 3rd gen cephalosporins.

Conditional Logistic Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to unisolated VRE patients</td>
<td>2.04*</td>
<td>0.0014</td>
</tr>
<tr>
<td>History of major trauma</td>
<td>9.27</td>
<td>0.020</td>
</tr>
<tr>
<td>Metronidazole therapy</td>
<td>3.04</td>
<td>0.040</td>
</tr>
</tbody>
</table>

*Per exposure-unit

Proximity to isolated VRE patients was not associated with increased risk.

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VRE Prevalence in 30 Healthcare Facilities, Siouxland, 1997 vs 1999

<table>
<thead>
<tr>
<th>Facility</th>
<th>Number (%) VRE-Colonized</th>
<th>Relative Risk</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>40 (2.2) 9 (0.5)</td>
<td>0.23</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Acute Care</td>
<td>10 (6.6) 0</td>
<td>0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Long-Term Care</td>
<td>30 (1.8) 9 (0.5)</td>
<td>0.31</td>
<td>0.001</td>
</tr>
</tbody>
</table>


Incidence Densities of VRE BSI in Two Neighboring Hospitals With Comparable Patient Populations

<table>
<thead>
<tr>
<th>Surveillance Cxs</th>
<th>VRE BSI</th>
<th>Pt.-days</th>
</tr>
</thead>
<tbody>
<tr>
<td>No –Hospital A*</td>
<td>218</td>
<td>1,271,715</td>
</tr>
<tr>
<td>Yes-Hospital B</td>
<td>72</td>
<td>875,730</td>
</tr>
</tbody>
</table>

BSI RR=2.1, 95%CI, 1.59-2.76

*Most Hospital A isolates were clonal with 4 clones accounting for >75% of BSI and most common clone accounting for 30% as compared with 37% and 14.5% at Hospital B, respectively.

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Studies Reporting Control of VRE
Using ASC & CP

<table>
<thead>
<tr>
<th>Incidence Rate Ratio</th>
<th>95% CI</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Comparison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 vs 1</td>
<td>0.63</td>
<td>0.38−1.05</td>
</tr>
<tr>
<td>2 vs 3</td>
<td>0.36</td>
<td>0.23−0.55</td>
</tr>
<tr>
<td>4 vs 3</td>
<td>0.68</td>
<td>0.54−0.85</td>
</tr>
</tbody>
</table>


Studies Reporting Control of VRE
Using ASC & CP


Could Hand Hygiene Alone Control MRSA Like This?

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Studies Reporting Failure of Standard Precautions to Control MRSA or VRE

Studies Reporting Failure of Standard Precautions to Control MRSA or VRE
ISOLATION GOWNS PREVENT HCWs FROM CONTAMINATING THEIR CLOTHES/HANDS

14 (40%) of 35 HCWs’ gowns were culture (+) for MRSA and ARE on exiting room (2-200 colonies recovered). Clothing underneath was culture (-). 11 (69%) of 16 HCWs wearing freshly laundered white coats had detectable contamination. 3 of 11 developed (+) hand cultures after touching the white coat.


CONTAMINATION OF GOWNS, GLOVES AND STETHOSCOPES

• Two thirds of examinations of VRE patients resulted in VRE contamination of gown, gloves and/or stethoscopes.
• Same rate of contamination whether the patient was infected or merely colonized.


Importance of Gowns for Controlling Contact Transmission of VRE

<table>
<thead>
<tr>
<th>Gloves</th>
<th>Gown &amp; gloves</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRE Rate per 100 patient-days</td>
<td>3.78</td>
</tr>
<tr>
<td>p=0.04</td>
<td></td>
</tr>
</tbody>
</table>

In a proportional hazards model adjusted for length of stay, ‘gloves only’ precautions were associated with a hazard ratio of 2.5, p=0.02, 95%CI=1.2-5.3)

Importance of Gowns for Controlling Contact Transmission of VRE

<table>
<thead>
<tr>
<th></th>
<th>Gloves</th>
<th>Gown &amp; gloves</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRE Rate per 1000 patient-days</td>
<td>19.6</td>
<td>9.1</td>
</tr>
<tr>
<td>p&lt;0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In a logistic regression analysis, ‘gown and gloves’ precautions were associated with an adjusted odds ratio of 0.43, p=0.02, 95%CI=0.27-0.68)


Environmental MRSA Contamination

- 70% of rooms had environmental contamination when the patient was colonized or infected and 42% of nurses’ gloves were contaminated after touching environmental surfaces without touching patient.1
- 7% of stethoscopes were contaminated with MRSA2
  - Wiping with 70% isopropyl alcohol significantly reduced colony counts on stethoscopes (p < 0.02).3
- Contaminated surfaces include patient’s gowns, floor, bed linens, blood pressure cuffs, overbed tables, stethoscopes, etc.1

2 Cohen. Fam Pract. 1997;14:446

Rates of Persistent Environmental VRE Contamination

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Bucket</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60/376 = 15.9%</td>
<td>0/135 = 0%</td>
</tr>
</tbody>
</table>

Chi Square = 25.7
p < 0.001

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Studies Reporting Long Term MRSA or VRE Control Using ASC & CP


Significantly Lower Rate of MRSA & VRE Among Patients Transferred from Nonacademic Hospital A Using ASC/CP

<table>
<thead>
<tr>
<th>MRSA</th>
<th>VRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Hospital A</td>
<td>12 (1.3%)</td>
</tr>
<tr>
<td>Others</td>
<td>189(4.8%)</td>
</tr>
</tbody>
</table>

RR=0.26, 95%CI=0.15-0.46  
RR=0.16,95%CI=0.05-0.49  
p=1.0X10^-6  
p=4.1X10^-4

Unpublished data, Calfee DP, Farr BM

Studies Reporting Control of MRSA & VRE in Nonacademic Settings Using ASC & CP


Hosted by Paul Webber  paul@webbertraining.com
A Webber Training Teleclass  www.webbertraining.com
Controlling MRSA & VRE
Presented by Dr. Barry Farr
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Figure 1. Hospital Setting: Proportion of S. aureus Nosocomial Infections Resistant to oxacillin (MRSA), by ICU Status

Antimicrobial Resistance Surveillance in Staphylococcus aureus blood isolates, Denmark, 1960-1995


CDC Guideline for Isolation Precautions
•The CDC guideline for isolation precautions recommends contact isolation for “patients known or suspected to be colonized or infected with epidemiologically important” antibiotic-resistant microorganisms.

SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-resistant Strains of Staphylococcus aureus and Enterococcus This guideline recommends that all healthcare facilities try to control MRSA & VRE by identifying colonized patients with active surveillance cultures so they can be cared for using contact precautions. It is posted on the 'Position Paper' section of the SHEA website (http://www.shea-online.org/PositionPapers.html). This site is accessible to nonmembers who are welcome to print a personal copy.

Muto et al, ICHE 2003;24:362-386.

Studies Showing Cost Benefit of ASC & CP for Controlling MRSA & VRE

Cost-benefit Analysis of Detecting and Isolating MRSA Colonized Patients on ICU Admission

• A prospective study in 14 French ICUs for 6 months found that only universal screening detected MRSA carriage with acceptable sensitivity. A cost-benefit analysis confirmed that universal screening and preventive isolation saved money.

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A Recent Study Reporting Cost Effectiveness of Active Surveillance Cultures and Contact Precautions for Controlling MRSA Spread

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>ASC &amp; CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA Rate per 1000 patient-days</td>
<td>5.4^</td>
<td>1.8^</td>
</tr>
<tr>
<td>Gown usage per patient-day</td>
<td>6.9*</td>
<td>4.6*</td>
</tr>
</tbody>
</table>

^p=0.10, *p<0.001

Gown costs decreased from $18,941 to $11,877.


UVA Named ‘Top 100’ US Hospital
5 Consecutive Years, 1998-2002

1. Risk adjusted mortality rates
2. Risk adjusted complication rates
3. Severity adjusted length of stay
4. Expense per adjusted discharge (for case mix and local wages)
5. Profitability
6. Index of outpatient activities
7. Index of total facility occupancy
8. Long-term growth in equity
9. Productivity (net patient revenue / total assets)

Solucient

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Antimicrobial Resistance
Surveillance in *Staphylococcus aureus* blood isolates, Denmark, 1960-1995


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