**MRSA Screening: Con**

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**Defining the Intervention**

- "Active Detection and Isolation (ADI)"
  - Screening patients for MRSA carriage, upon admission and periodically during hospitalization, and placing identified carriers in contact precautions
  - Will not discuss decolonization or "source control", which doesn’t require identifying carriers to implement
  - Will not discuss the myriad variations of ADI

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**Establishing common ground**

- MRSA is a very bad bug
- Infection prevention practices should be designed to prevent MRSA transmission and infection
- There is a role for ADI in MRSA prevention
  - One of several "second tier" interventions to be considered when "first tier" interventions fail to prevent MDRO transmission

Why shouldn’t all hospitals institute ADI for MRSA control?

- The effectiveness of ADI remains in question
- ADI interventions are complex and resource intensive
- ADI may have unintended adverse consequences
- ADI is not necessary for MRSA prevention
- ADI is a misguided and unsustainable infection prevention approach

The effectiveness of universal ADI remains in question…..

Effectiveness of ADI for MRSA

- Two systematic reviews, CDC guidance, and SHEA/APIC policy statements all summarize the literature and come to the same conclusion:
  - Existing evidence does not justify adoption of MRSA ADI as a routine infection prevention measure……why?

ADI: State of the Science

• Literature complicated, conflicting, and of “suboptimal” quality
  – All studies demonstrating effectiveness of ADI are quasiexperimental; many are single center, retrospective evaluations of outbreaks
  – Most studies used inappropriate statistical analysis
  – Conflicting data on ADI:
    • The only published experimental (controlled) study, showed no benefit of ADI
    • Quasi-experimental studies using interventions other than ADI showed similar MRSA reductions


One systematic review

• Examined studies of screening and isolation to reduce MRSA colonization & infection:
  – 46/254 studies met criteria for review
  – Most were interrupted time series (before/after)
  – Few were planned prospective studies
  – 45/46 employed multiple interventions
  – Consideration of potential confounders, measures to prevent bias, & appropriate statistical analyses “were mostly lacking”
    • 23/24 time-series studies used inappropriate statistical analyses…


Best Evidence for Effectiveness

• Design: Interrupted times series
• Setting: Brigham & Women’s Hosp, 1996-2004
• Interventions: sterile barrier precautions for CL placement, alcohol hand rub, hand hygiene campaign, MRSA ASC on admission & weekly for ICU patients → CP for infected/colonized patients
• Outcome: Health care associated MRSA BSI

Best Evidence for Effectiveness

Findings:
(1) 75% ↓ in MRSA BSI in ICU (p .007) & 40% ↓ in non-ICU (p .008) setting
(2) No change in MSSA BSI

Control period
Intervention period
Incidence rate ratio (CI95)

- MRSA infections/1,000 patient days 0.91 1.11 1.2 (0.9-1.7)
- MRSA SSIs/100 procedures 0.99 1.14 1.2 (0.8-1.7)
- MRSA acquisition/1,000 patient days 1.59 1.69 1.1 (0.8-1.4)


Best Evidence for Ineffectiveness

- Controlled, experimental study involving ~22,000 surgical patients, U. of Geneva Hospital, 2004-05
- Cross-over design in 12 wards (9 months in each phase):
  - Nasal & perineal MRSA swabs by PCR with CP & decolonization (mupirocin nasal ointment & CHG bathing x 5 days) for all (+) pts
  - No screening or decolonization


The universal ADI intervention is complex and resource intensive.....
Preparing for ADI
Meet with the lab director to discuss:

- Laboratory costs (Who pays?)
  - $1-3 million in lab costs for large hospital
- Laboratory personnel and workflow
  - How many new tests? How often to test?
- Turnaround time and test performance
  - Cultures take 2-3 days to return
    - To isolate, or not to isolate?
  - Faster TAT options:
    - Chromagar ($5 per plate), 18-24 hour TAT
    - Real time PCR ($25-45/test), 1-4 hours TAT

Preparing for ADI
Meet with nursing and administration to discuss:

- Increased staffing and isolation needs
- If only 15% of MRSA detected on clinical culture, ASC may increase contact precaution use by 2-4 fold!
  - Major impact on budget for isolation needs
  - Enhanced educational mission
  - Major impact on bed management

Preparing for ADI
Effects on patient throughput

- ADI complicates bed management, unless you have all private rooms
- Internal gridlock: boarding in ER, worsening ER overcrowding, ambulance diversion
- Patients on CP on average waited 6.6 days longer for a bed in a LTCF
- Patients on CP (+ cx from prior admit) waited 1 hour longer in the ED (time from admission order until arrival on ward)

Preparing for ADI:
New process measures

• HCW may not adhere to contact isolation
  – 2 studies place baseline adherence at ~20-30%!

• Observation of adherence to all aspects of contact precautions must be incorporated into hand hygiene observation
  – New tools, additional training
  – Increased efforts to improve adherence

• It makes no sense to seek out more patients for contact isolation, if HCWs are not adhering!


Does ADI achieve its primary process goal? (to isolate all carriers…)

• In 2007, ADI mandated in IL hospitals (ICU)
• ICU point prev. surveys (PPS) performed (N, 26)

<table>
<thead>
<tr>
<th>Percent of patients:</th>
<th>Adult</th>
<th>Neonatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swabbed at admission</td>
<td>94.9</td>
<td>97.9</td>
</tr>
<tr>
<td>Admission cx positive</td>
<td>9.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Point prev. cx positive</td>
<td>12.4</td>
<td>5.3</td>
</tr>
<tr>
<td>In CP at time of PPS- total:</td>
<td>26.3</td>
<td>7.5</td>
</tr>
<tr>
<td>pts with + admission cx:</td>
<td>86.8</td>
<td>85.7</td>
</tr>
<tr>
<td>pts with + MRSA on PPS:</td>
<td>52.0</td>
<td>39.3</td>
</tr>
</tbody>
</table>


ADI may have unintended adverse consequences…..
### Adverse Effects of Isolation

#### Psychological

- Studies using validated psychometric scales

<table>
<thead>
<tr>
<th>Venue</th>
<th>Patients</th>
<th>Findings</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 geriatric rehabilitation wards, UK</td>
<td>22 pts in contact precautions vs 20 non-isolated patients</td>
<td>↑ depression ↑ anxiety ↑ anger</td>
<td>&lt;0.01  &lt;0.01 0.06</td>
</tr>
<tr>
<td>U. of South Florida</td>
<td>27 pts in contact precautions vs 24 non-isolated patients</td>
<td>↑ depression ↑ anxiety</td>
<td>&lt;0.001 &lt;0.001</td>
</tr>
<tr>
<td>Spinal cord injury center, UK</td>
<td>16 pts in contact precautions vs 16 non-isolated patients</td>
<td>↑ anger</td>
<td>0.037</td>
</tr>
</tbody>
</table>


### Adverse Effects of Isolation

#### Reduction of nurse & physician visits

<table>
<thead>
<tr>
<th>Location</th>
<th>HCWs observed</th>
<th>Findings for patients in contact precautions</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duke U. Medical ICU</td>
<td>All</td>
<td>50% ↓ in contacts/hour</td>
<td>0.03</td>
</tr>
<tr>
<td>UVA Surgical ICU &amp; wards</td>
<td>All</td>
<td>ICU: 56% ↓ in contacts/hour Ward: 47% ↓ in contacts/hour</td>
<td>&lt;0.001 &lt;0.001</td>
</tr>
<tr>
<td>U. of Michigan Medical wards</td>
<td>Physicians</td>
<td>52% ↓ in exam of patients by attending physicians</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>


### Adverse Effects of Isolation

#### Safety issues

Study performed at Brigham & Women’s Hospital & Sunnybrook & Women’s (Toronto); n=468

<table>
<thead>
<tr>
<th></th>
<th>Isolated</th>
<th>Non-isolated</th>
<th>RR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS incomplete</td>
<td>15%</td>
<td>9%</td>
<td>1.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Days w/ no VS recorded</td>
<td>6%</td>
<td>1%</td>
<td>2.5</td>
<td>.02</td>
</tr>
<tr>
<td>Days w/ no nursing notes</td>
<td>14%</td>
<td>7%</td>
<td>1.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Days w/ no MD progress note</td>
<td>28%</td>
<td>13%</td>
<td>2.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Adverse events/1000 days</td>
<td>32</td>
<td>16</td>
<td>2.20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Supportive care failure*1/1000 patient days</td>
<td>11</td>
<td>1</td>
<td>8.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patient complaint</td>
<td>25%</td>
<td>3%</td>
<td>8.05</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*falls, pressure ulcers, fluid/electrolyte disorders

Risk Perspective:
Risk of Contact Precautions vs. MRSA Risk

<table>
<thead>
<tr>
<th>Event</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression in isolated patients</td>
<td>1:3</td>
</tr>
<tr>
<td>Adverse events in isolated patients</td>
<td>1:3</td>
</tr>
<tr>
<td>MRSA colonization</td>
<td>1:30</td>
</tr>
<tr>
<td>MRSA infection</td>
<td>1:120</td>
</tr>
</tbody>
</table>

The risk of an adverse event due to contact precautions is 40-fold higher than the risk of developing MRSA infection.


ADI is not necessary for MRSA prevention.....

Reducing MRSA without ADI

<table>
<thead>
<tr>
<th>Setting</th>
<th>Interventions</th>
<th>Outcome</th>
<th>↓ in MRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult ICUs 820-beds Virginia</td>
<td>Hand hygiene Surv/Feedback Bundles, CHG</td>
<td>Device-assoc MRSA inf. rates</td>
<td>2006: 73% 2009: 90%</td>
</tr>
<tr>
<td>Hosp wide 840-beds Australia</td>
<td>Hand hygiene Enviro cleaning Culture change</td>
<td>MRSA BSI rates</td>
<td>57%</td>
</tr>
<tr>
<td>Hosp wide 350-beds Australia</td>
<td>Hand hygiene Surv/Feedback</td>
<td>New MRSA MRSA BSI rates</td>
<td>43% 40%</td>
</tr>
</tbody>
</table>

MRSA infections: >90% reduction in adult ICUs

Trends in S. aureus CLABSI in ICUs, NHSN 1997-2007

UK Experience

57% decline in MRSA bacteremia
Don’t take it from me!

[Dr. Jernigan] also said the hospitals' experience argues against the universal testing, or active surveillance, of hospital patients for MRSA, an ongoing debate in hospitals.

“I think this shows that hospital-wide active surveillance is not necessary to show a big decrease in MRSA,” he said.


ADI is misguided and unsustainable infection prevention approach…..

To prevent MRSA infections, must one identify the entire reservoir? What about other HAI pathogens?
ICU Infections due to MRSA

463 hospitals, ~25,000 infections

<table>
<thead>
<tr>
<th>Infection</th>
<th>% due to MRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI</td>
<td>6</td>
</tr>
<tr>
<td>UTI</td>
<td>1</td>
</tr>
<tr>
<td>VAP</td>
<td>13</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
</tr>
</tbody>
</table>


EPIC II: ICU infections worldwide
1265 ICUs in 75 countries

<table>
<thead>
<tr>
<th>Organism</th>
<th>% total ICU infxns</th>
<th>% change EPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram pos</td>
<td>47</td>
<td>↑ 12%</td>
</tr>
<tr>
<td>S. aureus</td>
<td>21</td>
<td>↑ 11%</td>
</tr>
<tr>
<td>MRSA</td>
<td>10</td>
<td>↓ 9%</td>
</tr>
<tr>
<td>Gram neg</td>
<td>62</td>
<td>↑ 20%</td>
</tr>
</tbody>
</table>


Eight in 10 hospital infections going unreported ‘because of Government targets’

"The Department has achieved significant reductions in MRSA bloodstream and C. diff infections, for which it set national targets," he said.

But, in so doing, it has taken its eye off the ball regarding all other healthcare-associated infections – which actually constitute most by far, two-thirds, of all infections.

Rates of MRSA and C. diff have fallen in recent years but still affect more than 2,000 patients a month, official figures show.

However, the PAC report warns that there is evidence that other infections are on the rise.

A voluntary reporting system run by the Health Protection Agency found that bloodstream infections in hospitals rose by 30 per cent between 2003 and 2007.

www.telegraph.co.uk
www.hpa.org.uk
Infection Prevention

- Overarching goal: decrease all infections to the irreducible minimum
  - Will also reduce those due to MRSA
- Principles:
  1. Implement evidence-based, non-pathogen specific interventions
  2. Monitor and provide feedback on compliance with process metrics
  3. Invest resources in building infrastructure


Conclusions

- Population-based (horizontal) infection prevention approaches have the greatest impact (10% MRSA + 90% “other”)
- MRSA ADI has unintended consequences that impact patient safety, well being & satisfaction
- Approach to MRSA control must be an institution-specific, local decision developed in the context of the institution’s priorities and resources
Which hospital has been more successful in MRSA control?

University of Iowa (unpublished data)
**ASC-CP Ethical Issues**

- Given the potential for harm, should informed consent be obtained?
- Does patient autonomy trump public health? What to do with patients who refuse cultures?
- Unfair distribution of burdens & benefits—colonized patient bears burden of isolation (& no benefit) while the benefit accrues to uncolonized patients
- Is it fair to isolate colonized patients, when the data for effectiveness of this approach are questionable & other control methods are available?
- Should hospitals implementing ADI increase nurse:patient ratios to mitigate the safety concerns?
- Can the cost of active surveillance be justified? What is the opportunity cost?


**STAR ICU Trial**

- Federally funded, randomized multicenter study of 19 ICUs comparing ADI to standard care (CP for clinical cultures only)

<table>
<thead>
<tr>
<th>New colonization or infection</th>
<th>ASC-CP</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>16%</td>
<td>13%</td>
</tr>
<tr>
<td>VRE</td>
<td>39%</td>
<td>33%</td>
</tr>
<tr>
<td>MRSA or VRE</td>
<td>40%</td>
<td>36%</td>
</tr>
</tbody>
</table>


The only randomized trial of ASC for MRSA control had a long (~5 d) lab turnaround time

Conflicting data on ADI

  - Largest controlled trial of ASCs
  - Prospective crossover design: surgery wards
  - No difference in MRSA infection rates

  - Evanston/NW Healthcare: 3 hospitals
  - No ASC → ASC in ICUs → Universal ASC + decolonization with mupirocin and CHG
  - No control group
  - 70% reduction in MRSA infection rates
VA Directive: Results so far

- MRSA prevention initiative began 1/07
  - 18 highly selected sites began 1 yr earlier
- Included screen of all admissions
- From ’06 to ’08, MRSA rates increased
  - 15% ↑ in 18 sites, 54% ↑ elsewhere
- From ’07 to ’08, MRSA rates increased
  - 2% ↑ at 18 sites, 36% ↑ elsewhere


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Annual Cost of Enhanced Infection Control

Alternative strategies

- MRSA Active Surveillance
  - $900,000
  - Lab supplies
  - 1 lab tech

- Additional infrastructure
  - $180,000
  - 0.5 MD epi
  - 1 ICP
  - 1 biostatistician