Methicillin-Resistant Staphylococcus aureus (MRSA) Background

- Compared to MSSA
  - Increased cost ($3,700 per infection)
    - Higher readmission, length of stay
  - Increased mortality
  - Fewer therapeutic options
- Colonization precedes infection (10:1)
  - Can persist for months – years
- Emergence of community MRSA in 1998

Methicillin-Resistant Staphylococcus aureus (MRSA)

Control Measures

- Spread by direct contact
- Asymptomatic MRSA carriers → reservoir for transmission
- Infection control strategies - variably effective:
  - Screening
  - Contact precautions
  - Contact tracing
  - Decolonization

Admission Screening

Risk-Factor Based (Targeted) Screening

- Screening based on pre-defined high-risk factors

Universal Screening

- Screening all patients for MRSA upon admission

- In past:
  - Lack of agreement, inconclusive evidence
  - Mandatory in certain jurisdictions
  - Patient safety movement

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Cost Analysis of Universal Screening vs. Risk Factor-Based Screening for MRSA
Dr. Virginia Roth, The Ottawa Hospital
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**Methicillin-Resistant Staphylococcus aureus (MRSA)**

**Impact of Screening**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>HCA-MRSA Acquisition</th>
<th>HCA-MRSA Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal vs No Screening</td>
<td></td>
<td>45-70%</td>
</tr>
<tr>
<td>Universal vs Targeted Screening</td>
<td>NA</td>
<td>0.12-52%</td>
</tr>
<tr>
<td>ICU Universal vs No Screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical Patients vs No Screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Targeted vs No Screening</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Glick et al. Am J Infect Control 2014
Universal vs Risk Factor Screening for Methicillin-Resistant Staphylococcus aureus in a Large Multicenter Tertiary Care Facility in Canada

V. R. Roth, MD,1,2,3 T. Longpre, MSc,2 M. Taljaard, PhD2,3 D. Coyle, MD,2,3 K. N. Suh, MD,1,2,3 K. A. Muldoon, MPH,4 K. Ramotar, PhD2,3 A. Forster, MD1,2,3

SETTING

- The Ottawa Hospital
  - Multicenter tertiary care facility
  - 1,200 beds: med, surg, obstetrics, ICU, mental health, rehab
- MRSA Control Measures:
  - Targeted admission screening
  - Contact Precautions: hand hygiene, gowns, gloves
  - Contract screening, blocked beds
  - Private room, bathroom
  - Dedicated patient care equipment
  - Decolonization not routinely performed

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Staff at the Ottawa Hospital are Battling Outbreak of a Superbug

CJOH-TV

“Superbug” Hits City Hospitals
The Ottawa Citizen

Ottawa Hospital’s Civic Campus hit with Outbreak of Resistant Bacteria
CHRO

Hospital Battles Superbug
The Sun

Superbug Outbreak at the Ottawa Hospital, Civic Site
CJOH

OUR BURNING PLATFORM FOR CHANGE

- Risk-factor based (targeted) admission screening limited:
  - Compliance 30 – 70%
  - Missed Community MRSA

- Economic models supported universal screening
  - Projected > $400,000 annual savings

- Recent switch to PCR testing

Lee et al. Infect Control Hosp Epidemiol 2010

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**OBJECTIVES**

- Assess the impact of universal admission screening on healthcare-associated MRSA rates
  - All patients admitted through the ED
  - All elective admissions
  - All patients transferred from another institution

- Compare the annual and per patient costs of universal versus risk factor-based MRSA screening

**STUDY DESIGN**

Quasi-experimental
- Risk Factor-Based Screening: 24 mo
- Universal Screening: 20 mo

1° outcome: HCA-MRSA acquisition per 100,000 patient-days
- Segmented regression analysis

2° outcomes (to account for threats to validity)
- Incidence of HCA - *C. difficile*
- Mupirocin use
- Regional MRSA rates

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LAB METHODS

- Screening swabs from nares, rectum and open wounds
- Incubated overnight in broth
- Tested using RT-PCR
- Culture confirmation of PCR positive
- Results available within 24 hr

COST ANALYSIS

- Operational costs of screening
  - Specimen collection, lab costs
- Costs of additional cases identified
  - Infection control, contact precautions, housekeeping, private room
- Cost savings of fewer nosocomial cases
  - Healthcare costs of colonization & infection
- Sensitivity analysis

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METHODS – DECISION MODEL

RESULTS – STUDY POPULATION

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Admissions</td>
<td>76,273</td>
<td>61,782</td>
</tr>
<tr>
<td>Number Screened (%)</td>
<td>22,271 (29.2)</td>
<td>51,815 (83.8)</td>
</tr>
<tr>
<td>Total MRSA positive cases on admission (%) of admissions</td>
<td>745 (1.0)</td>
<td>1,621 (2.6)</td>
</tr>
<tr>
<td>MRSA Detection Rate per 1,000 admissions</td>
<td>9.8</td>
<td>26.2</td>
</tr>
<tr>
<td>Nosocomial MRSA Cases</td>
<td>323</td>
<td>321</td>
</tr>
<tr>
<td>Nosocomial MRSA rate /100,000 pt days</td>
<td>41.8</td>
<td>47.5</td>
</tr>
<tr>
<td>MRSA Bacteremia Cases</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>MRSA Bacteremia rate /100,000 pt days</td>
<td>1.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Healthcare-Associated MRSA Rates Pre- and Post-Intervention (Per 100,000 Patient Days)

<table>
<thead>
<tr>
<th>Segment</th>
<th>MRSA Rates</th>
<th>CDI Rates</th>
<th>Mupirocin Prescription Rates</th>
<th>Regional MRSA Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate</td>
<td>p-value</td>
<td>Rate</td>
<td>p-value</td>
</tr>
<tr>
<td>Baseline rate per 100,000 pt-days</td>
<td>46.79</td>
<td>41.01</td>
<td>76.22</td>
<td>7.39</td>
</tr>
<tr>
<td>Change in pre-intervention rate (24 month risk factor screening period)</td>
<td>0.40</td>
<td>0.482</td>
<td>-0.95</td>
<td>0.026</td>
</tr>
<tr>
<td>Change in pre-post rate (Immediate rate difference)</td>
<td>-1.11</td>
<td>0.923</td>
<td>12.52</td>
<td>0.142</td>
</tr>
<tr>
<td>Change in post-intervention rate (20 month universal screening period)</td>
<td>-0.21</td>
<td>0.826</td>
<td>0.24</td>
<td>0.753</td>
</tr>
</tbody>
</table>

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COST ANALYSIS OF RISK FACTOR-BASED VS UNIVERSAL ADMISSION SCREENING

<table>
<thead>
<tr>
<th></th>
<th>% Patients Screened</th>
<th>Annual Cost</th>
<th>Cost per Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Factor</td>
<td>30</td>
<td>$780,000</td>
<td>$128.03</td>
</tr>
<tr>
<td>Universal</td>
<td>83</td>
<td>$1.94M</td>
<td>$145.79</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>$1.16M</td>
<td>$17.76</td>
</tr>
</tbody>
</table>

Universal Screening Costs

SENSITIVITY ANALYSIS - COST

- Universal screening less costly when:
  - MRSA prevalence is low (1-3%): $3.03 - $30.75 saved per patient screened
  - Acquisition rates are very high (>60%): $0.74 saved per patient screened

- Little impact:
  - Probability of false negative, unknown
  - Probability of MRSA acquisition, MRSA infection
CONCLUSIONS

Universal screening (vs Risk factor-based):
▶ Improved MRSA detection 3-fold
▶ Did not reduce MRSA acquisition
▶ Did not impact MRSA bacteremia
▶ Cost an additional $17.75 per patient

WHY DIDN’T IT WORK?
▶ Compliance with infection control practices <100%
▶ Moderately low MRSA prevalence: 2.6%
▶ 84% admission screening compliance ≠ “universal”
▶ Did not include impact of universal decolonization

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WHAT'S AN ICP TO DO?

- Screening
  - Less costly rapid detection methods
  - Risk-factor based (depending on local epidemiology):
    - All patients admitted through ED
    - All direct transfers
    - All admissions to ICU and Rehab
- Strict adherence to infection control measures
- Consider universal decolonization
  - May prevent 44% of colonization and 45% of infections

Gidengil et al. Infect Control Hosp Epidemiol 2015
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Thanks to Teleclass Education

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