Methicillin Resistant
*Staphylococcus aureus* MRSA
and Fire Departments

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Background

- *S. aureus* found in 25-35% of general US population, MRSA in 1-2%
- Colonizes the nose, skin, urogenital tract
- Methicillin resistant *S. aureus* [MRSA] first identified in 1940’s
- Today 100,000 MRSA infections/year; ¾ found in the community
- Community Acquired MRSA [CA-MRSA] primarily 1 strain which has toxins and can infect all ages without risk factors
MRSA Disease

- *S. aureus* and MRSA does not cause disease unless the skin is broken or bacteria gets inside the body.
- Skin infection often looks like a bug bite.
- *S. aureus* and MRSA can be inhaled and cause respiratory disease.
- Carriage of MRSA for > 1 year increases risk of disease.
Community MRSA Disease

Respiratory disease

*Skin infections most likely for Fire personnel
Seasonal/Swine Flu and MRSA 2009-10

- Many of the deaths in 1918 flu pandemic was due to secondary infections
- Today secondary infections with MRSA and other respiratory bacterial pathogens still very important cause of morbidity/mortality
Fire Station Study

- Bacterial cultures in 1 Seattle and 1 Snohomish Fire Station
- Cultured surfaces in/on Fire Apparatus
- Cultured surfaces in living quarters
- Snohomish cultured washing machine
Fire Station Study

- Determine how many samples are positive for:
  - MRSA, *S. aureus*,
  - other staphylococci [CoNS],
  - other methicillin resistant staphylococci [MRCoNS]
- More likely to see MRCoNS, use as a surrogate for MRSA
- Detect level normally $\leq 10\%$ of what is on the surface
- All MRSA were characterized
### Culture Results

From Table 1. Culture Results

<table>
<thead>
<tr>
<th>Medic, Engine, &amp; Station</th>
<th>Total # samples taken</th>
<th># samples positive for staphylococci</th>
<th># samples positive for MRSA [mec+]</th>
<th># samples positive for S. aureus [mec-]</th>
<th># samples positive for MRCoNS (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snohomish</td>
<td>276</td>
<td>209</td>
<td>9</td>
<td>8</td>
<td>55</td>
</tr>
<tr>
<td>Seattle</td>
<td>322</td>
<td>310</td>
<td>12</td>
<td>9</td>
<td>90</td>
</tr>
</tbody>
</table>
## Level of methicillin + staphylococci

### From Table 2

<table>
<thead>
<tr>
<th></th>
<th>Snohomish</th>
<th>Seattle Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td># samples</td>
<td>216</td>
<td>262</td>
</tr>
<tr>
<td># samples with 1-5 cfu</td>
<td>116</td>
<td>99</td>
</tr>
<tr>
<td># samples with 6-20 cfu</td>
<td>26</td>
<td>74</td>
</tr>
<tr>
<td># samples with 21-40 cfu</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td># samples with &gt;40 cfu</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

- 29% range 54-67 cfu
- 4.6% range 41-100 cfu

- 54% range 0-100 cfu

<table>
<thead>
<tr>
<th>Category</th>
<th>Snohomish</th>
<th>Seattle Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 cfu</td>
<td>54%</td>
<td>38%</td>
</tr>
<tr>
<td>6-20 cfu</td>
<td>12%</td>
<td>8%</td>
</tr>
<tr>
<td>21-40 cfu</td>
<td>28%</td>
<td>8%</td>
</tr>
<tr>
<td>&gt;40 cfu</td>
<td>3.2%</td>
<td>29%</td>
</tr>
</tbody>
</table>
MRSA Found

- MRSA + samples in medic trucks, fire engines and fire trucks
- Found both community and hospital acquired MRSA
- Same MRSA strains in Fire Apparatuses and Fire Station’s living space
- MRSA spread from Fire Apparatuses into living space
MRSA Positive Fire Apparatuses
MRSA Positive Fire Apparatuses
One MRSA Strain

Fire Engine seat belt ← Medic Truck outside handle

TV Remote control
Other MRSA Positive Surfaces
One MRSA Strain

medic Truck electronics, gurney straps, soft bag handle

kitchen sink handle ← men’s bathroom outer door
MRSA Positive Surfaces in Living Quarters
Gas/Brake Pedals in this Fire Truck

MRSA+
One MRSA Strain

Fire Engine foot pedal ← Medic Truck floor

↓

Bunk Jacket

↓

Bathroom Counter
How MRSA Moves into Fire Station

- Medic truck the most likely source of MRSA
- Fire apparatuses may also be source of MRSA
- MRSA is spread from hands, shoes, bunk gear, clothing into Fire Station living space
- Once in Fire Station continues to spread
- **Aim to reduce the spread of MRSA by reducing carriage of MRSA from garage into living space**
Summary

- Current methods miss ~ 90% of the MRSA present on surfaces
- Both Fire Stations had similar percentage of MRSA, *S. aureus*, and MRCoNS
- Both hospital and community acquired MRSA were identified IN BOTH STATIONS
- Current disinfectant protocols are not adequate to keep the MRSA levels low on/in the Fire apparatuses and the Fire Stations
Evaluating Decontamination Process

- Determine if disinfecting contaminated surfaces once/week is adequate
- Use materials commonly found in Medic truck
- Seed $10^6$ cfu/ml MRSA contact plate
- Disinfect then contact plate
- Contact plates on day 1, 3 and 4
Disinfectants

- No disinfectant eliminates 100% of the bacteria
- Good disinfectant activity reduces bacterial count by $10^3$
- If $10^6$ bacteria disinfectant will reduce to $10^3$
- Disinfection of patient contaminated spaces, surfaces & equipment including Fire department apparatus: should be done daily

- Thorough cleaning should be done after MRSA positive client
Disinfectants

- Reduce or cover all fabric, woven/webbed materials
- Purchase new furniture with easily cleanable surfaces
- Cover all electronics, TV remotes, computer keyboards, mattresses to allow for daily cleaning
- Disinfect handles of doors, trucks, cupboards, washing machines
- Automatic hand sanitizers by all doors from garage to living space
Other Suggestions

- More signs need to remind personnel to wash hands regularly
- Proper disposal of biohazardous waste needed at all times
- If MRSA infections persist in Fire Station personnel: then determining level of MRSA carriage and the type of strain present would be advised
Next Steps

- Make changes at Fire Station to reduce MRSA spread from garage to living quarters
- Estimate need ~8 weeks to see changes in bacterial cultures
- Develop educational material which will be evaluated by Fire Station personnel
- Validated educational materials distributed
“Relax – MRSA will get you before the Asian Flu”
Work accomplished with the assistance of:

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**Advisory Board Members:** Seattle Fire Department & Snohomish County Fire District #1 personnel

**Technical Expertise:** Kim Favorite, Seattle Fire Dept. and Kevin Fetter, Snohomish Fire District

Seattle and Snohomish Fire Stations personnel