Objectives

- To present an outbreak investigation of CAMRSA skin infections among members of a professional football team
- To summarize risk factors in football players and other sports participants
- To present infection control and prevention measures in football outbreaks
Sports Participation in U.S.

- National Federation of State High School Associations (2003)
  - 6,903,552 (53%)
    - Football 1,032,420 (18%)
    - Basketball 1,002,797 (13%)
    - Wrestling 244,984 (4%)

- National Collegiate Athletic Association (2002-03)
  - 377,641
    - Football 59,640 (16%)
    - Basketball 30,669 (8%)
    - Wrestling 5,986 (2%)

- Does not account for professional, extramural, club teams (rugby)
Skin Injuries: A Common Risk for Infection

- Most frequent and well recognized skin infections
  - Herpes simplex, S. aureus, Streptococcus pyogenes
  - “Scrum pox”, “herpes rugbiorum”, “scrum strep”
- Few reports in the literature
- Few training opportunities in infection control for athletic trainers
First Reports of S. aureus Outbreaks in Football

- New Hampshire 1964\(^1\)
- North Carolina 1977\(^2\)
- Illinois 1979\(^2\)

\(^1\)Pollard JG. The Staphylococcus plagues a football team. College Health 1966;234-238.

First MRSA Infections in Sports

- 1994: High school wrestling team in Vermont\(^1\)
  - 7 (22%) of 32 had MRSA
  - Follow-up nasal carriage survey of all wrestlers
    - 40% colonized with S. aureus
    - 0% with MRSA

- 1996: England\(^2\)
  - 5 rugby players with MRSA
  - Treated with erythromycin and clarithromycin


Although outbreaks of methicillin-resistant *Staphylococcus aureus* (MRSA) usually have been associated with health-care institutions, MRSA is emerging as a cause of skin infections in the community. This report summarizes several reported clusters of skin and soft tissue infections associated with MRSA among participants in competitive sports.

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- **November 9, 2003:**
  - State DOH and CDC were notified of a cluster of MRSA abscesses among Team X
The Bigger They Are The Harder They Fall

CAMRSA Among Professional Football Players - 2003
Objectives for Investigation

- Determine if skin infections were due to healthcare-associated MRSA or due to community-associated MRSA
- Identify possible sources and risk factors for infection
- Develop recommendations for control of the outbreak
Methods
MRSA case
- Skin infection in team X player or staff during 2003 football season
- MRSA on culture

Observational studies
- Field investigation
- Training facility
  - Contact
  - Towel sharing
  - Hand washing
  - Other hygiene practices
- **Cohort study**
  - Players’ positions
  - Demographic characteristics
  - Healthcare exposures
  - Skin abrasions (turf burns)
  - Personal hygiene
  - Use of saunas, whirlpool spas, training and therapy equipment
S. aureus Colonization Study

- Nasal Swab Survey
  - Players
  - Staff
- Turf Burn Swab Survey
  - Players
Environmental Study

- Weight Training
- Physical Therapy
- Game Play
- Whirlpool Spa
- Sauna
Results
Team X Players

- 58 Players
- Median Age: 26 years (22-41)
- Race: white - 30 (52%)
- Weight group*:
  - BMI > 30 31 (58.5%)
  - BMI 25-30 21 (39.6%)
  - BMI 18.5 – 24 (Normal weight) 1 (1.9%)

*NCHS classification

Body Mass Index (BMI) Formula: $\frac{\text{kg}}{\text{m}^2}$
Cases of MRSA Infection in Team X Players, 2003

Number of Episodes

Date of Onset

August  September  October  November
3  10  17  24  31  7  14  21  28  5  12  19  26  2  9  16  23  30  7

0  1  2
Eight MRSA Cases

- All infections were:
  - at turf burn sites
  - on elbows, forearms, or knees
- 6 required surgical incision and drainage
- Three first case-players received Keflex
- 2 received IV abx
Cases of MRSA Infection in Team X Players, 2003

Intervention

Date of Onset

Number of Episodes
Case Player Position

Offense

Defense
Case Player Position
## Cohort Study

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Total Number</th>
<th>Cases</th>
<th>Attack Rate</th>
<th>RR</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lineman/Linebacker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>27 (51%)</td>
<td>5</td>
<td>19%</td>
<td>10.6</td>
<td>0.021</td>
</tr>
<tr>
<td>No</td>
<td>26 (49%)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>BMI &gt;30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>31 (58%)</td>
<td>5</td>
<td>16%</td>
<td>7.9</td>
<td>0.048</td>
</tr>
<tr>
<td>No</td>
<td>22 (42%)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Antimicrobials in last year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>30 (59%)</td>
<td>5</td>
<td>17%</td>
<td>7.8</td>
<td>0.049</td>
</tr>
<tr>
<td>No</td>
<td>21 (41%)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

* Chi-Square with $\alpha = 0.05$
Observational Study

- Turf burns
  - ~3/player/week
  - Frequently not covered
  - Trainers had poor hand hygiene

- Personal hygiene
  - Frequent towel sharing
  - Skipping showers before using spas

- Close contact
  - Lineman and linebackers
  - Team meetings
  - Adjacent lockers
Observational Study

- Training facility
  - Equipment not cleaned
  - No guidelines for cleaning of spas, sauna, and steam room
- Onsite Pharmacy for distributing antimicrobials
## Review of Antimicrobial Use

### Prescriptions/Person/Year

<table>
<thead>
<tr>
<th>Team X</th>
<th>General Population*</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>0.2</td>
<td>p &lt; 0.001</td>
</tr>
</tbody>
</table>

*NHANES/NAMCS data for males aged 22-41 years, 2002*
# S. aureus Colonization and Environmental Study

<table>
<thead>
<tr>
<th></th>
<th># Samples</th>
<th>MRSA</th>
<th>MSSA # samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nasal Swabs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Players</td>
<td>58</td>
<td>None</td>
<td>23 (40%)</td>
</tr>
<tr>
<td>Staff</td>
<td>26</td>
<td>None</td>
<td>12 (46%)</td>
</tr>
<tr>
<td><strong>Uninfected Turf Burns</strong></td>
<td>2</td>
<td>None</td>
<td>2 (100%)</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spa Water</td>
<td>20</td>
<td>None</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>Taping Gel</td>
<td>6</td>
<td>None</td>
<td>1 (100%)</td>
</tr>
</tbody>
</table>
Laboratory Methods and Characterization of S. aureus

- S. aureus isolates
  - 2 MRSA abscess isolates
  - 41 MSSA isolates

- Methods
  - Antimicrobial susceptibility testing
  - Toxin testing (PVL, A-E, H, TSST)
  - Pulsed-Field Gel Electrophoresis (PFGE) and BIONUMERICS® software
  - PCR for typing resistance gene (SCCmec)
Team X MRSA Abscess Isolates

- Resistant to methicillin and all other β-lactams
- Resistant to erythromycin
- Produce Panton-Valentine leukocidin
<table>
<thead>
<tr>
<th>NFL Team X</th>
<th>NFL Team Y</th>
<th>Abscess</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>College Football</td>
<td></td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>College Football</td>
<td></td>
</tr>
<tr>
<td>Colorado</td>
<td>Fencer</td>
<td></td>
</tr>
<tr>
<td>Mississippi</td>
<td>Prison</td>
<td>Abscess</td>
</tr>
<tr>
<td>Texas</td>
<td>Jail</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>Prison</td>
<td>Children</td>
</tr>
<tr>
<td>Tennessee</td>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>Texas</td>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>Missouri</td>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>Children</td>
<td></td>
</tr>
</tbody>
</table>
Community-Associated MRSA Compared to Hospital MRSA

Team X
NFL Team Y
California
Pennsylvania
Colorado
Mississippi
Texas
Georgia
Tennessee
Texas
Missouri
California
USA300
USA100
USA200

Abscess
College Football
College Football
Fencer
Prison
Jail
Prison
Children
Children
Children
Community
Hospital Strain
Hospital Strain
Team X MRSA and MSSA Isolates

MRSA: Abscess
MSSA: Nasal Swab
MSSA Nasal and Environmental
Community

- CA-MRSA
  - Stable Clone
  - β-lactam resistant
  - PVL+

Football Team X

Players
- Turf burns
- Close contact
- Poor hygiene

Team
- Increased antimicrobial use
- Contaminated environment
- Inadequate cleaning

Skin Abscess cluster
CA-MRSA Outbreak Interventions

- Enhanced disease surveillance among members of the cohort
  - Systematic and routine examination of skin
  - Reporting of skin abrasions and infections by players

- Infection treatment and containment
  - Drainage and culture of abscesses
  - Targeted antimicrobial therapy
  - Improved wound care
CA-MRSA Outbreak Interventions

- Temporary exclusion from competition/practice
  - If contamination from the wound can not be prevented
- Improved hand and personal hygiene
  - Access to sinks and alcohol hand gels
  - Single use towels
  - Wall soap dispensers
- Enhanced environmental cleaning
  - Multiuse training equipment
  - Whirlpool spa
CA-MRSA Outbreak Interventions

- Decolonization
  - Regimens
    - Chlorhexidine washes (pulse or single use)
    - Intranasal mupirocin
  - Data for decolonization in outbreak prevention are limited
  - A reasonable approach includes
    - In a closely-associated cohort
    - In an individual patient with recurrent disease
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  Victoria Fraser

- Santa Clara County Health Department
  Sarah Cody
2003 Football Season Investigations

- Connecticut College (Begier, EIS ‘03)
  - 13 infections, 2 players hospitalized
  - Risk factors for infection:
    - turf burns
    - body shaving
    - whirlpool use

- Los Angeles College (Nguyen, EIS ’03)
  - 10 infections, 4 players hospitalized
  - Risk factors for infection:
    - Skin abrasions
    - Linemen position
    - Towel and soap sharing
## 2003 Football Season Investigations

<table>
<thead>
<tr>
<th>Team</th>
<th># Infections</th>
<th>Risk Factors</th>
<th>Intervention</th>
</tr>
</thead>
</table>
| Connecticut College (Begier, EIS ’03) | 13 infections, 2 hospitalized | - turf burns  
- body shaving   
- whirlpool use  | Hexachlorophene soap,  
enhanced personal hygiene  
skin abrasion management  |
| Los Angeles College (Nguyen, EIS ’03) | 10 infections, 4 hospitalized | - skin abrasions  
linemen  
towel and soap sharing  | Hexachlorophene soap and showers  
Decolonization (mupirocin)  |