Healthcare Superbugs: The Re-Emergence of Hospital Pathogens

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Staphylococcus aureus Facts

- Half of all *S. aureus* strains in U.S. healthcare facilities are resistant to methicillin
- Historically, methicillin-susceptible *S. aureus* (MSSA) strains were mostly acquired in the community, whereas methicillin–resistant strains (MRSA) were typically acquired in healthcare facilities
- There have been increasing reports of MRSA acquired in the community setting
Community Associated MRSA

• Definition:
  – MRSA clinical isolate from a patient *without* established risk factors for MRSA infection
  – Risk factors include:
    • Within the last year:
      – History of hospitalization, surgery, or residence in a long term care facility
    • Presence of indwelling catheter or percutaneous device
    • Prior history of MRSA infection or colonization

Adapted from Fridkin et al. New England Journal of Medicine, April 7, 2005
Community Acquired MRSA

- PVL positive Community acquired MRSA
  - Panton-Valentine-Leukocidin (PVL) gene
    - Cytotoxin produced by <5% of S. aureus strains
    - Lina et al* screened for PVL in 172 S. aureus strains
      - 93% of strains associated with furunculosis
      - 85% of strains associated with severe, necrotizing pneumonia

MRSA-Skin and Soft Tissue Infections
MRSA-Necrotizing Pneumonia
Clinical and Molecular Epidemiology of Nursing Home-Associated *Staphylococcus aureus* Bacteremia

- 7 year retrospective review of hospital medical records of nursing home residents from 22 separate facilities who had *S. aureus* bacteremia
  - 39 episodes of *S. aureus* bacteremia were identified
    - 15 MSSA
    - 24 MRSA

Clinical and Molecular Epidemiology of Nursing Home-Associated *Staphylococcus aureus* Bacteremia

- **Source of bacteremia**
  - Urinary tract -18% of all episodes
  - 44% episodes with unidentifiable focus
- **PFGE analysis of MRSA strains**
  - Two pulsed-field types predominated
    - USA100- (N = 13)
    - USA 800-like strains (N = 7)

Nursing Home-Acquired Bloodstream Infections

• Review of NH-acquired BSIs over 20 years
  – Low Incidence of 0.3 episode per 1,000 resident care-days
  – Sources of BSI changed little:
    • Urinary tract infection -50% of the episodes
    • Bacteriology
      – Gram-negative bacilli -50%
        » Escherichia coli
        » Resistance to fluoroquinolones and broad-spectrum penicillins and cephalosporins was uncommon
        » MRSA was the most common MDRO causing BSI

Epidemiology of *Staphylococcus aureus* Colonization in Nursing Home Residents

- 213 residents +/- indwelling device, from 14 nursing homes
- Samples obtained from the nares, oropharynx, groin, perianal area, wounds, and enteral feeding tube site
- Standard microbiology to identify MRSA
  - Pulsed - field gel electrophoresis, PCR detection of Panton - Valentine leukocidin, and SCC*mec* and *agr* typing

Mody et al. *Clinical Infectious Diseases* 2008;46:1368–1373
Epidemiology of *Staphylococcus aureus* Colonization in Nursing Home Residents

- 86 colonized with MRSA
  - 75 with MRSA only
  - 11 with both MRSA and MSSA
- 45 were colonized with MSSA only

Frequency of colonization at multiple sites with MSSA / MRSA

Mody et al. *Clinical Infectious Diseases* 2008;46:1368–1373
Epidemiology of *Staphylococcus aureus* Colonization in Nursing Home Residents

- Residents with devices more likely to be MRSA colonized at multiple sites
- Eleven different strains of MRSA PFGE phenotypes
  - 73 (85%) were colonized with hospital-associated SCC\textit{mec} II strains
  - 8 (9%) were colonized with community-associated SCC\textit{mec} IV strains
  - 2 were PVL positive

*Mody et al. Clinical Infectious Diseases 2008;46:1368–1373*
Antibiotics for CA-MRSA

• CA-MRSA bacteria are usually susceptible to more types of antibiotics than are healthcare-associated strains of MRSA
  • Typically susceptible to
    • Bactrim
    • Clindamycin
    • Doxycycline
    • Vancomycin
    • Linezolid
    • Rifampin
# New Treatments for MRSA/VRE

<table>
<thead>
<tr>
<th>Drug</th>
<th>FDA Indication</th>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daptomycin (Cubicin)</td>
<td>cSSI MRSA/MSSA Bacteremia</td>
<td>Bactericidal MRSA/MSSA VRE</td>
<td>IV formulation only Dose dependent myositis</td>
</tr>
<tr>
<td>Linezolid (Zyvox)</td>
<td>HA + CA Pneumonia cSSI/SSI</td>
<td>Bacteriostatic MRSA/VRE (E.faecium)</td>
<td>IV and PO formulation Thrombocytopenia Neuropathy</td>
</tr>
<tr>
<td>Tigecycline (Tygacil)</td>
<td>cSSI cIA Infections</td>
<td>Bacteriostatic Gram positive Gram negative Anerobes</td>
<td>IV formulation only Hepatic impairment requires dose modification Does not have pseudomonas coverage</td>
</tr>
<tr>
<td>Ceftibiprole 4th generation ESC</td>
<td>Pending</td>
<td>MSSA / MRSA</td>
<td>IV formulation only Non-inferior to Vancomycin in clinical trial</td>
</tr>
</tbody>
</table>
MRSA-Skin and Soft Tissue Infections

- Incision and Drainage is mainstay of treatment
- Antibiotics if there secondary cellulitis for 10-14 days
  - Doxycycline
  - Bactrim
  - Clindamycin
  - Linezolid
MRSA and VRE Treatment

• Treat infection and not colonization
• Complicated skin and soft tissue infections; bacteremias; UTI/urosepsis
  – Maximally bactericidal therapy, consider ID consult
    • Vancomycin (MRSA)
    • Daptomycin (MRSA + VRE)
    • Tigecycline (MRSA + VRE)
    • Linezolid (MRSA + VRE- faecium)

• MRSA Pneumonia
  – Vancomycin (+/- Clindamycin) OR Linezolid
    • * Clindamycin or Linezolid associated with decreased toxin production in laboratory setting and may be warranted in RX of CA-MRSA necrotizing pneumonia
What about active MRSA screening?

• The debate about the value of MRSA ASC continues in part because of:
  – Limited reports of success so far
  – Some reports of the failure of screening
  – The costs of screening and isolation
  – The unwanted side effects of patient isolation
  – The inability to find sufficient isolation rooms for all patients

What about active MRSA screening?

- Focusing hospital resources on a single antibiotic-resistant pathogen as a sole approach to infection control is inherently flawed
- Emergence of MDROs as well as the recognition of the value of team-based infection control programs supports a population-based approach to IC

Screening for MRSA: A Flawed Hospital Infection Control Intervention

- Focus resources on population-based infection control intervention program utilizing evidence-based processes
  - Hand hygiene promotion and surveillance
  - Promotions/surveillance and feedback
    - Central line checklists
    - Head of bed elevation
    - Review and discontinuation of unnecessary catheters

Screening for MRSA: A Flawed Hospital Infection Control Intervention

Screening for MRSA: A Flawed Hospital Infection Control Intervention

Screening for MRSA: A Flawed Hospital Infection Control Intervention

1 = *Staphylococcus aureus* resistant to methicillin
2 = *Enterococci* resistant to vancomycin
3 = *Pseudomonas aeruginosa* resistant to imipenem
4 = *Acinetobacter* spp resistant to imipenem
5 = *Candida* spp resistant to fluconazole

VCUMC Approach to MRSA Active Surveillance – select patient populations

- **High risk surgeries**
  - Cardiothoracic surgery
    - CABG
    - Valve replacements
  - Neurosurgeries
    - Craniotomies
    - Spinal fusion
  - Orthopedic surgery
    - Joint replacement

- **Outbreak situations**
  - For epidemiologic surveillance and source/cross transmission control
Highly Effective Regimen for Decolonization of Methicillin-Resistant *Staphylococcus aureus* Carriers

- Prospective cohort study with a mean follow-up period of 36 months
- 62 patients
  - Decolonization treatment was performed
  - At least 6 body sites were screened for MRSA (including by use of rectal swabs) before the start of treatment

Highly Effective Regimen for Decolonization of Methicillin-Resistant *Staphylococcus aureus* Carriers

- Standardized decolonization treatment
  - Mupirocin nasal ointment
  - Chlorhexidine mouth rinse
  - Full-body wash with chlorhexidine soap for 5 days.
  - Intestinal and urinary-tract colonization treated with oral vancomycin and cotrimoxazole
  - Vaginal colonization treated with povidone-iodine or with chlorhexidine
  - Successful decolonization was considered to have been achieved if results were negative for 3 consecutive sets of cultures

Highly Effective Regimen for Decolonization of Methicillin-Resistant *Staphylococcus aureus* Carriers

Decolonization was successful in 54 (87%) of the patients in the intent-to-treat analysis.

Figure 2. Number of decolonization courses needed for successful methicillin-resistant *Staphylococcus aureus* (MRSA) eradication, overall (bold line) and stratified according to number of sites initially colonized by MRSA ($P = .004$)

Extended Spectrum Beta-Lactamases
Beta-Lactamases: What are they?

• Enzymes produced by certain bacteria that provide resistance to certain antibiotics
• Produced by both gram positive and gram negative bacteria
• Found on both chromosomes and plasmids
Epidemiology

• Today, 30 – 50% of E. coli are resistant to ampicillin and amoxicillin due to a beta-lactamase

• ESBLs have been reported for *E.coli, Klebsiella, Enterobacter, Proteus, Pseudomonas, Salmonella, Serratia*

• ESBLs have emerged as pathogens of epidemiologic significance
  – In long term care facilities emerging as uropathogens
Beta-lactamase inhibitor

- Clavulanic acid + amoxicillin = Augmentin
- Clav. Acid + ticarcillin = Timentin
- Sulbactam + ampicillin = Unasyn
- Tazobactam + piperacillin = Zosyn

**Good News:** Beta-lactamase inhibitors inhibit the beta-lactamase thereby not allowing the molecule to hydrolyze the antibiotic. Most ESBLs remain susceptible to Beta-lactamase inhibitors

**Bad News:** some ESBL producing bacteria produce large amounts of beta-lactamase thereby overwhelming the beta-lactamase inhibitors
The story is more complicated….

- Multiple antimicrobial resistance is often a characteristic of ESBL producing gram-negative bacteria.
  - Ceftazidime
  - Cefotaxime
  - Ceftriaxone
  - Aztreonam

- Genes encoding for ESBLs are frequently located on plasmids that also carry resistance genes for:
  - Aminoglycosides
  - Tetracycline
  - TMP-SULFA
  - Chloramphenicol
  - Fluoroquinolones
Extended-spectrum β-lactamases in long-term-care facilities


Extended-spectrum β-lactamases in long-term-care facilities


Prevalence and risk factors of extended-spectrum beta-lactamase-producing *Escherichia coli* and *Klebsiella pneumoniae* in an Israeli long-term care facility

- Urine samples positive for *E. coli* or *K. pneumoniae* from 1/2003 to 10/2003 were tested for the presence of ESBL
  - Overall rate of ESBL+ was 25.6%
    - 350 *E. coli* isolates
      - 77 (22%) were ESBL+
    - 84 *K. pneumoniae* isolates
      - 34 (40.5%) were ESBL+

However: ESBL producing organisms are still susceptible to:

- Cephæmycins:
  - Cefoxitin
  - Cefotetan

- Carbapenems:
  - Meropenem
  - Imipenem

Carbapenems are becoming the therapeutic option of choice
What about skin decolonization for gram negative rods?

- 4% chlorhexidine whole-body washing and *A. baumannii* skin colonisation among patients in a medical ICU
  - Daily whole-body disinfection with 4% CG can significantly reduce *A.baumanii*
    - *A.baumanii*-BSIs decreased from 4.6 to 0.6 per 100 patients (P ≤ 0.001)
- Although not studied in LTCF may be an effective IC adjunct

**Clostridium difficile**

- *Clostridium difficile* is a gram-positive, anaerobic, spore-forming bacillus that is responsible for the development of antibiotic-associated diarrhea and colitis.
Epidemiology of CDAD

- *C. difficile* is the leading cause of nosocomial enteric infection
- Three million new cases of *C. difficile* diarrhea and colitis in United States hospitals per annum
- CDAD affects 10% of hospitalized patients

Hospital-acquired *Clostridium difficile*-associated disease in the intensive care unit setting: epidemiology, clinical course and outcome

- Historical cohort study on 58 adults with CDAD occurring in intensive care units at VCUMC
- In ICU patients with CDAD, *advanced age* and increased severity of illness at the onset of infection were independent predictors of death
- The in-hospital mortality was 27.6%

Marra A, Edmond MD, Wenzel RP and Bearman G. *BMC Infectious Diseases* 2007, 7:42
## Antibiotics and CDAD

<table>
<thead>
<tr>
<th>Highly associated</th>
<th>Moderately Associated</th>
<th>Rarely Associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>Other Beta-lactam antibiotics</td>
<td>Parenteral Aminoglycosides</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>Sulfonamides</td>
<td>Tetracyclines</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td>Erythromycin</td>
<td>Chloramphenicol</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Trimethoprim</td>
<td>Metronidazole</td>
</tr>
<tr>
<td></td>
<td>Quinolones</td>
<td>Vancomycin</td>
</tr>
</tbody>
</table>
Risk Factors and Pathophysiology

Receipt of antibiotics

Disruption of microflora in colon

Exposure and colonization by C. difficile

Release of toxins A and B with resultant mucosal injury
Antibiotic Associated Diarrhea Without Colitis

• Common in hospitalized patients
• Diarrhea is mild
  – 3-4 loose watery stools per day
  – Cramping
• Physical examination is normal with only minimal lower abdominal tenderness
• Fever, leukocytosis, and dehydration are mild or absent
• C. difficile toxins present in stool
• Sigmoidoscopic examination is normal
Pseudomembranous Colitis

- Appears as raised yellow or off-white plaques ranging up to 1 cm in diameter scattered over the colorectal mucosa
- Similar clinical symptoms of diarrhea, fever, leukocytosis and abdominal pain
Fulminant Colitis and Toxic Megacolon

- 2 or 3 percent of patients
- Marked leukocytosis (>30,000 to 40,000 WBC/microL)
- Fever, chills, dehydration and metabolic (lactic) acidosis
Diagnosis: ELISA for Toxin Detection

- More rapid assays with comparable sensitivity (70 to 90 percent) and specificity (99 percent)
- Some detect Toxin A only
  - Toxin A variant strains (toxin A-negative, toxin B-positive strains) relatively infrequent
    - (1-2% of all isolates)

Emergence of Highly Toxigenic Strain

- Hospital and nursing home outbreaks of severe disease particularly in elderly patients
- Strain is generally resistant to fluoroquinolones
- Prior receipt of fluoroquinolones is a risk factor
- Increase in mortality
- 10% of case patients required admission to the ICU
- 2.5 percent underwent an emergency colectomy
Toxin gene-variant and highly toxigenic strains - NAP1/BI/027

- Genes
  - *tcdA* Toxin A
  - *tcdB* Toxin B
  - *tcdC* porin gene
    - Partial deletions of *tcdC*
      - The expression of *tcdA* and *tcdB* is down regulated by the *tcdC* gene

Mechanism for the overproduction of toxins in the NAP1/BI/027 strain is a partial deletion in the *tcdD* gene resulting in overproduction toxins A and B
States with BI/NAP1/027 strain of *C. difficile* (N=38), November, 2007

Updated Nov. 9, 2007

http://www.cdc.gov/ncidod/dhqp/id_Cdiff_data.html
Vancomycin vs Metronidazole?

• Randomized, prospective, double blinded placebo controlled trial

• Treatments
  – Oral metronidazole 250mg QID x 10 days
  – Oral vancomycin 125mg QID x 10 days

• Outcomes
  – Clinical cure/ recurrence
    • Stratified by disease severity

Zar et al. Clinical Infectious Diseases, 2007:45: 302-7
# Vancomycin vs Metronidazole?

<table>
<thead>
<tr>
<th>Severity</th>
<th>Clinical Cure</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metronidazole</td>
<td>Vancomycin</td>
<td>P Value</td>
<td></td>
</tr>
<tr>
<td>Mild CDAD N=81</td>
<td>90%</td>
<td>98%</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Severe CDAD N=69</td>
<td>76%</td>
<td>97%</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

Disease severity scoring system: one point each was given for age >60 years, temperature >38.3°C, serum albumin <2.5 mg/dL (25 g/L), or peripheral white blood cell count >15,000 cells/µL within 48 hours of enrollment. Two points were given for endoscopic evidence of pseudomembranous colitis or treatment in the intensive care unit. Patients with >2 point considered to have severe disease.

<table>
<thead>
<tr>
<th></th>
<th>Vancomycin</th>
<th>Metronidazole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonic levels</td>
<td>&gt; 500 mcg/mL</td>
<td>0–10 mcg/mL</td>
</tr>
<tr>
<td>In vitro activity</td>
<td>≤ 1.0 mcg/mL</td>
<td>≤ 1.0 mcg/mL</td>
</tr>
<tr>
<td>FDA-approved</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clinical trials</td>
<td>Unbeaten</td>
<td>Beaten</td>
</tr>
<tr>
<td>Mild disease</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Severe disease</td>
<td>Superior</td>
<td>Inferior</td>
</tr>
<tr>
<td>Relapse rate</td>
<td>10%–25%</td>
<td>10%–25%</td>
</tr>
<tr>
<td>Cost/day (AWP)</td>
<td>$36/$17</td>
<td>$10</td>
</tr>
<tr>
<td>Promotion of VRE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

AWP = average of wholesale price; FDA = Food and Drug Administration; VRE = vancomycin-resistant enterococci.
Nitazoxanide vs Metronidazole

Nitazoxanide – oral antiprotozoal agent

Prospective, randomized, double blind study

Treatments:
Metronidazole 250mg po QID x 10 days
Nitazoxanide 500mg bid x 7 days
Nitazoxanide 500mg po bid x 10 days

Nitazoxanide was at least as effective as metronidazole in treating *C. difficile* colitis

Relapse- Increasingly More Common

• Relapse of CDAD occurs in 10-50% of patients
  – Likely due to persistence and germination of *C. difficile* spores
  • However, up to 50% of relapses may be due to reinfection with a new strain of *C. difficile*

Mylonakis et al. *Archives of Int Med.* 2001; 161:525-33
Malnick SDH. *Annals of Pharmacotherapy.* 2002;36:1767-75
Relapse

- There are no evidence based guidelines for the treatment of multiple relapses

| 1st Recurrence                      | • Repeat metronidazole therapy  
|                                    | • Repeat Vancomycin therapy     
|                                    | • Nitazoxanide                  |
| Multiple Recurrences               | • Dose titration of vancomycin  
|                                    | • Vancomycin or metronidazole with probiotic agent  
|                                    | • Vancomycin + colestipol        
|                                    | • Vancomycin+rifaximin           
|                                    | • Fecal transplantation          |
Vancomycin

• Dose titration with pulse dosing
  – Week 1: 125mg QID
  – Week 2: 125mg BID
  – Week 3: 125 mg QD
  – Week 4: 125mg QOD
  – Weeks 5 and 6: 125 mg every 3 days

  • Intermittent administration of antibiotics permits germination of residual spores on the off days
  • With the reintroduction of antibiotics, the organism is consequently destroyed

Anion Binding Resins

- Resins bind toxins produced in CDAD
- Bowel flora are not altered by resins
- Anion-exchange resins bind vancomycin and resin must be taken two or three hours apart

Cholestyramine
Treatment of recurrent antibiotic-associated pseudomembranous colitis

- 11 patients with relapses of antibiotic-associated pseudomembranous colitis
  - Treated with a tapering dose schedule of vancomycin and colestipol
- All patients responded and were asymptomatic at least 6 wks

Tedesco FJ. Am J Gastroenterol 1982 Apr;77(4):220-1
# Treatment summary

| Mild CDAD          | • Discontinue offending antibiotic  
|                   | • Oral Metronidazole               |
| Moderate to severe | • Oral vancomycin                  
|                   | • Oral metronidazole               
|                   | • IV metronidazole (ileus) + oral vancomycin via NG tube 
|                   | • Antibiotics + IVIG               |
| 1st Recurrence    | • Repeat metronidazole therapy    
|                   | • Repeat Vancomycin therapy       
|                   | • Nitazoxanide                     |
| Multiple Recurrences | • Dose titration of vancomycin     
|                   | • Vancomycin or metronidazole with probiotic agent 
|                   | • Vancomycin + cholestipol         
|                   | • Vancomycin+rifaximin             
|                   | • Fecal transplantation            |
| Severe ileus, toxic megacolon | • Surgical evaluation for complete colectomy |
Healthcare Associated Urinary Tract Infections

• Virtually all patients develop bacteriuria by 30 days of catheterization
• Of patients who develop bacteriuria, 3% will develop bacteremia
• Vast majority of catheter-associated UTIs are silent
  These comprise the largest pool of antibiotic-resistant pathogens in the hospital

Treat Infection and Not Colonization

• Is this a UTI vs asymptomatic bacteruria?
  – Use clinical judgement
    - Urine WBC- pyuria
    - Bacterial colony counts > $10^3$
    - Clinical signs/symptoms
• No antibiotic treatment for bacteruria
  - resolves with catheter removal
• 7-10 days of therapy for UTI
• Empiric therapy typically initiated pending microbiologic results
Prevention of Nosocomial UTIs

- Avoid catheter when possible & discontinue - **MOST IMPORTANT**
- Aseptic insertion by trained HCWs
- Maintain closed system of drainage
- Ensure dependent drainage
- Minimize manipulation of the system
- Silver coated catheters
Catheter Associated UTI

• Implement an organization-wide program to identify and remove catheters that are no longer necessary
  – Daily review of the necessity of continued catheterization

• Electronic or other types of reminders
  – *Automatic stop orders requiring renewal of the order*

Lo, E et al. *Infect Control Hosp Epidemiol* 2008; 299; supplement 1
Infection Control
The inanimate environment is a reservoir of pathogens

Recovery of MRSA, VRE, C. diff, CNS and GNR

Devine et al. Journal of Hospital Infection. 2001;43;72-75
Lemmen et al Journal of Hospital Infection. 2004; 56:191-197
The Inanimate Environment Can Facilitate Transmission

Contaminated surfaces increase cross-transmission

Opportunities for Hand Contamination are Multiple
Hand Contamination in HCWs

Hand Hygiene

*Clostridium difficile*

• Hand washing with antiseptic impregnated soap is preferred method for hand hygiene

• Alcohol based hand sanitizers do not consistently and adequately remove *Clostridium difficile* spores.

http://www.bumc.bu.edu/www/bumc/ehs/images/hands.jpg

http://www.bumc.bu.edu/www/bumc/ehs/images/hands.jpg
Contact Precautions for drug resistant pathogens.

Gowns and gloves must be worn upon entry into the patient’s room

Visitors: Report to nurse before entry

- Handwashing after all patient / environmental contact and glove removal.
- Gloves required for all patient / environmental contact.
- Long sleeved gown required for all patient / environmental contact.
Bare Below the Elbows for Inpatient Care

• Mandate across UK hospitals
• Recommended practice at VCUMC
• Ensure good hand and wrist washing

short sleeves, no wrist watch, no jewelry
avoidance of ties when carrying out clinical activity
Strategies for Control of MDROs in Nursing Homes

- Aggressive promotion of hand hygiene
- Meticulous compliance with contact isolation
- Indwelling central venous catheters and urinary catheters
  - Placed by formally trained personnel; compliance with insertion ‘checklist’
  - Discontinuation of unnecessary lines
    - Protocolized, daily review of catheters for discontinuation
- Consider chlorhexidine bathing of patients
- Consider Bare Below the Elbows Approach
- Active surveillance cultures for MRSA/VRE
  - Controversial; may not be effective in endemic settings
- Environmental decontamination by housekeeping
Summary

• Long term care facilities are not immune to the emergence of MDROs
  – MRSA, VRE, ESBL-NGR

• MRSA and CA-MRSA is an emerging issue in LTCFs
  – Treatment should be directed at infection and not decolonization
  – New antibiotics exist for MRSA and VRE
Summary

• Decolonization protocols exists for MRSA
  – Several decolonization attempts may be required
• ASC for MRSA/VRE are controversial
  – Efficacy is arguable for the control of MDROs in endemic settings
• *C. difficile* is re-emergent, relapses may be common, oral vancomycin may be the treatment of choice
Summary

- Infection Control Measures for LTCF
  - Hand hygiene
  - Contact Isolation Precautions
  - Bare below the elbows
  - Chlorhexidine bathing of patients
  - Use of central line insertion ‘checklists’
  - Daily review and prompt discontinuation of CVC and urinary catheters
  - Environmental decontamination
The End