Controlling Multidrug Resistant Drug Resistant Organisms (MDROs)

10th Annual Fleming Infection Prevention and Infectious Diseases Symposium

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One day, someone in these pictures will be receiving healthcare. Potentially in your hospital or office. I don’t want them (or anyone) to get an infection or die.
That day is today
Do contact precautions work for the control of MDRO’s?

Are some pathogens more important than others?

- Vancomycin Resistant enterococci
- Staph aureus
  - MRSA
  - VISA
  - VRSA
- GNR-MDRO (Gram negative rods)
- MDR Acinetobacter
- ESBL
- CRE
  - NDM CRE
## Costs of HAIs

<table>
<thead>
<tr>
<th>Infection Type</th>
<th>Cost Estimates</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Historical Data</td>
</tr>
<tr>
<td>VAP</td>
<td>4,947²</td>
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<tr>
<td>UTI</td>
<td>3,803¹</td>
</tr>
<tr>
<td>SSI</td>
<td>2,734²</td>
</tr>
<tr>
<td>BSI</td>
<td>33,268³</td>
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<tr>
<td>MRSA</td>
<td>NS</td>
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</tbody>
</table>

U.S. MDRO Trends

STILL INCREASING
PA is the 10th highest MRSA prevalence rate in the US.
KPC-producing CRE in the United States 2017

http://www.cdc.gov/hai/organisms/cre/TrackingCRE.html
Reducing MDROs
Where to Start?

<table>
<thead>
<tr>
<th>VRE</th>
<th>MDR Acinetobacter</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>ESBLs</td>
</tr>
<tr>
<td>VISA/VRSA</td>
<td>CRE</td>
</tr>
<tr>
<td>Cdiff</td>
<td>NDM CRE</td>
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<tr>
<td></td>
<td>Other MDR GNRs</td>
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</tbody>
</table>
Where can we find MDROs?

• Hands of HCWs caring for infected/colonized patients
• Gloves of HCWs caring for infected/colonized patients
• Gowns/coats of HCWs
• Ties of HCWs
• Stethoscopes - 7% of stethoscopes were contaminated with MRSA
• Computer keyboards
• Stuff in the patients room
  – 70% of MRSA rooms had MRSA recovered from the environment
    • Patient’s gowns
    • Bed linens
    • BP cuffs
    • Overbed tables
    • Equipment
    • Supplies in the room

Everywhere
Pick Your Poison

• Do they ALL Matter
• Should they all be eliminated
• An unfocused approach is what has been done for years
  – IT DOESN’T WORK
• Focus, Focus, Focus
  – One by one
  – Once success is achieved/Culture Transformed
  – Move On…

They will try to beat you down…
Barriers to accomplishing effective Prevention

- Despite traditional and current infection control guidelines, strategies to prevent bad outcomes have not been widely and successfully implemented.
- Locations that had prevention strategies in place have decided that they are too labor intense and are not implementing them or disbanding them.
  - Is it just too hard. Should endemic centers just stop trying?
Consequences of MDROs

**Issues**
- Frequent – Too Many
  - 30-60% of colonized become infected.
- TOXIC/Deadly!
- Costly
  - Increases LOS

**Treatments**
- SEVERELY limited
  - Too Few
- Less efficacious
- TOXIC/Deadly!
- Costly

International Society for Pharmaco economics/Outcome Research – 5/16/05
The Questions?

1. Do MDRO Control Measures work?
   a. For outbreaks?
   b. Even if they have become endemic?

2. Are Contact precautions necessary to control these pathogens?

3. Are patients in contact precautions as safe as other patients?
Extended-spectrum beta-lactamase (ESBL)

- MDR GNR pose one of the most vexing infectious disease challenges
- β-lactamases hydrolyze the β-lactam ring and render antibiotics ineffective
- Common antibiotics like penicillins and cephalosporins don’t work

- The plasmids carrying the gene encoding the ESBLs frequently carries other genes encoding resistance to aminoglycosides and TMP/S (Bactrim)
- Typically carbapenems or quinolones are used.
  - Newer reports with quinolone resistance too.

URINE CULTURE

Culture: >100,000 col/mL Proteus mirabilis
>100,000 col/mL Escherichia coli Extended spectrum beta lactamase producer (ESBL). Treat with Carbapenem or Quinolone if susceptible. Patient isolation required.

ESCHERICHIA COLI

<table>
<thead>
<tr>
<th>MIC (mcg/mL)</th>
<th>MIC Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>&lt;=16</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>&gt;2</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>&lt;=4</td>
</tr>
<tr>
<td>Imipenem</td>
<td>&lt;=4</td>
</tr>
<tr>
<td>Levofoxacin</td>
<td>&gt;4</td>
</tr>
<tr>
<td>Meropenem</td>
<td>&lt;=1</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>&lt;=32</td>
</tr>
<tr>
<td>Sulfatracetampr</td>
<td>2/38</td>
</tr>
<tr>
<td>Tebamicin</td>
<td>&lt;=4</td>
</tr>
</tbody>
</table>
ESBL Clinical Impact

• Mortality (42%)
  – Higher in patients ESBL bacteremia
    • Did not receive appropriate antibiotic therapy

• Duration of hospital stay/hospital charges
  – Higher in patients ESBL infections than with non-ESBL-producing organisms of the same species.
  – Median length of hospital stay post infection of 29 days vs 11 days in those with non-ESBL-producing KP infection.
    • Brooklyn Antibiotic Resistance Task Force

ESBL Risk Factors

- Seriously ill patients
- Prolonged hospital stays
- Invasive medical devices
  - Urinary catheters
  - Endotracheal tubes
  - Central Lines
    - Especially if prolonged duration.
- Heavy antibiotic use

ESBL Transmission within health-care
- Acute to nursing home (NH)
- NHs to acute - Chicago Long-term Care
  - 46% of residents were ESBL colonized (all E. coli)
  - All had been in the NH, without intercurrent hospitalization > 6 months.
  - Patients from 8 NHs served as a reservoir for ESBL introduction into acute-care

Study for Monitoring Antimicrobial Resistance Trends (SMART)

• Studies resistance patterns worldwide from 2002 to 2011
  – 92,086 intra-abd infections
  – 24,705 UTIs
  – Significant increases in ESBL infections across all continents, except Africa.
  – >40% of isolates from Asia were ESBL in 2011.
  – Latin America, the Middle East, Africa, Europe, and the South Pacific displayed a prevalence of ESBL of ~ 10%–35%.

• US data 2012 - SENTRY
  – ESBL E.coli, Klebsiella species, and Proteus collected from 72 hospitals across 9 US regions
    • 12.2% (701/ 5739) of isolates were ESBL
    • Highest region - NE
      – Overall at 23%
      – 35% of KP were CRE

ESBL Transmission Data

- In 100% of the > 50 studies at least 2 patients were colonized or infected with genotypically similar strains
  - Implies patient-to-patient transmission.
- A number of outbreaks have been described with dissemination of a single clone of genotypically identical ESBL
  - Clones have been found to persist for more than 3 years

ESBL Modes of Spread
(Same as all other MDROs)

- Health-care Workers
  - Hands
  - Clothing, uniforms, laboratory coats, or isolation gowns
    - Can become contaminated with pathogens after care of a patient colonized/infected with an infectious agent
      - New in the CDC isolation guidelines (HICPAC), 2007; 1-219. – cannot re-use same isolation gown even on same patient

- Common environmental sources
  - Ultrasonography Coupling Gel
  - Bronchoscopes
  - Blood Pressure Cuffs
  - Thermometers (Axillary)
  - Cockroaches
  - Patients' Soap
  - Sink Basins
  - Babies' Baths

**IMPORTANT** - Patients may have asymptomatic colonization with ESBL-producing organisms without signs of overt infection.
- These patients represent an important reservoir of organisms.
- For every patient with clinically significant ESBL infection at least one other patient exists in the same unit with GI colonization with an ESBL
ESBL Infection Prevention Measures

i. Active Surveillance
   Testing (perirectal swabs) to identify ESBL colonized

ii. Evaluation for the presence of a common environmental source

iii. Campaign to improve hand hygiene

iv. Contact isolation for patients found to be colonized or infected

• Close attention to practices that may lead to breakdowns in good infection control
  – Audit for compliance

• Changes in antibiotic policy
  Reduce antibiotic consumption
  Ceftazidime restriction alone is insufficient to control continued infections with ESBL-producing organisms
  • Some forced to withdraw cephalosporins as an entire class in order to reduce ESBLs.

The “I REALLY MEAN IT” Approach!!

The Yeahs
Veterans Affairs Initiative to Prevent MRSA Infections

- Implementation of a MRSA bundle was associated with a significant decline in MRSA transmission

- MRSA Bundle Components
  - Nasal surveillance for MRSA
  - Contact precautions for patients with MRSA
  - Hand hygiene (HH)
  - Institutional culture change whereby infection control was everyone's responsibility

Veterans Administration (VA)
National MRSA HAI Rates Facilities

- Health Care-Associated MRSA Infections per 1000 Patient-Days
- ICUs
- Non-ICUs
- P=0.50
- P<0.001
- Retrospective data
Nationwide VA Quarterly Rates of HCA MRSA Infections

A ICUs

Health Care-Associated MRSA infections per 1000 Patient-Days

Pneumonia Bloodstream Urinary Tract Skin or Soft Tissue

B Non-ICUs

Health Care-Associated MRSA Infections per 1000 Patient-Days

Pneumonia Bloodstream Urinary Tract Skin or Soft Tissue
Acute Care vs. Long-Term Care

Endemic KPC
Prevention of Colonization and Infection by *Klebsiella pneumoniae* Carbapenemase–Producing Enterobacteriaceae in Long-term Acute-Care Hospitals

2008: cluster of KPC at a Chicago LTAC

2011: REGIONAL OUTBREAK

9-fold increase in colonization prevalence among patients in area LTACs
Methods: Stepped-wedge cluster-randomized trial

- **KPC Rectal swab cultures** on admission and every other week
  - Preemptive contact isolation on admits pending culture results
  - Patients with a positive screen *or* clinical cultures were presumed to remain colonized and not rescreened

- **Contact isolation and geographic separation of KPC + patients**
  - Single room or ward cohort
  - Universal contact isolation of all high-acuity patients where geographic separation was not feasible

- **Universal daily bathing**
  - 2% chlorhexidine-impregnated cloths

- **HCW education** - adherence monitoring

*Ertapenem disk, PCR for blaKPC*
Results

- Compliance - Adherence to intervention components was relatively high:
  - Swab collection, isolation >90%
  - PPE at room entry, HH at room exit, CHG bathing >70%
  - HH at room entry 25% (!)

- KPC Clinical culture positivity - ↓ 32% (any source)
  - KPC bacteremia ↓ 56%

- KPC Prevalence –
  - Despite stable admit rate KPC prevalence ↓ from 46→34%
    - (p<.001)
  - Definite/possible KPC acquisition decreased by half (p=.004) during the intervention period
Can you teach an old Dog a New Trick?

*Kirkland and Weinstein, CID 2009:*

“Current use of contact isolation may be driven more by strongly held beliefs and a desire to do something to prevent HAIss than by unambiguous evidence.

*Weinstein RA et al, CID 2015:*

“Implementation of a bundled intervention was associated with clinically important and statistically significant reductions in KPC colonization and infection.”

Guess you can teach an old dog a new trick!!
Conclusions

Control Programs that include a BUNDLED approach
• Active surveillance testing
• HH/Contact precautions
• Environmental Cleaning

WORK to ↓MDROs
The Nays

STAR-ICU Study
Contact Precautions: More Is Not Necessarily Better
STAR-ICU 2011

Strategies to Reduce Transmission of Antimicrobial Resistant Bacteria in Intensive Care Units

Intervention to Reduce Transmission of Resistant Bacteria in Intensive Care

Study Aim

- “Is an intensive infection control strategy better than standard infection control strategy at reducing MRSA/VRE incidence in adult ICUs
  - Multicenter, cluster randomized trial

- **Intensive Control Strategy (I) N=10**
  - Contact precautions for pts known to be MRSA/VRE colonized/infected
  - Promote HH and standard precautions
  - Active surveillance cultures (ASC) - MRSA/VRE
    - On admission
    - Weekly intervals
  - Universal gloving until ASC results were available

- **Standard Control Strategy (S) N=8**
  - Contact Precautions for pts known to be MRSA/VRE colonized/infected
  - Promote HH and standard precautions

Baseline
4-6 months 4/05-11/05

Randomized/Implementation
3 months 12/05-2/06

Intervention – 6 months
3/06-8/06

Use of HH, Gloves, and Gowns by ICU HCWs

Would we study drug efficacy in patients who only received it half the time??

A) Intervention ICUs — Component Measures for Contacts with Patients Assigned to Contact Precautions

B) Intervention ICUs — Component Measures for Contacts with Patients Assigned to Universal Gloving

C) Control ICUs — Component Measures for Contacts with Patients Assigned to Contact Precautions

D) Control ICUs — Component Measures for Contacts with Patients Assigned to Standard Precautions

50% 50%
Results – Incidence Density of New Colonization or Infection Events

<table>
<thead>
<tr>
<th>Incidence Density of New Colonization or Infection Events</th>
<th>I</th>
<th>S</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA and VRE</td>
<td>40.4</td>
<td>35.6</td>
<td>0.35</td>
</tr>
<tr>
<td>MRSA</td>
<td>16.0</td>
<td>13.5</td>
<td>0.39</td>
</tr>
<tr>
<td>VRE</td>
<td>38.9</td>
<td>33.4</td>
<td>0.53</td>
</tr>
</tbody>
</table>

- **NO Difference**
  - Results support NO effect (equal infectiveness)

1st Question - WHAT!!!
2nd Question WHY!!!
Methodology Flaws

- **Too Low** Too Long Too Short
- Sensitivity of Assay – **Too Low**
  - No chromogenic media/ or PCR
- Prolonged time to ASC positivity – **Too Long**
  - 5.2 days after culture +/- 2 days to obtain culture
  - Entered into password protected site
  - Investigator had to actively get results and forward to the patient care
    - > Average LOS (4.9 days)
    - 58% of patients were discharged prior to ASC results!
- Barrier Compliance – **Too Low**
  - Observations only done 8A - 8P
  - Intervention **NEVER** fully implemented
- Time of intervention – 6 months **Too Short**
  - Many studies have shown that reductions are not linear
  - Reductions often not realized until > 6 months

A 2.7-year study of AST and isolation in VA hospitals by Jain/Muder et al. showed significant control hospital-wide. **The flaws of the study design prohibit assessment of Intensive Control Strategy**
Contact Precautions: More Is Not Necessarily Better


How Do You Measure BETTER?
Study Features

• **Objective**
  – To determine whether increases in contact isolation precautions are associated with decreased adherence to isolation practices among healthcare workers (HCWs).

• **Design**
  – Prospective cohort study from 2/09 – 10/09 (9 Months)

• **Setting**
  – 11 teaching hospitals

• **Methods**
  – 1,013 observations conducted on HCWs.
  – Additional data included:
    • # of persons in isolation
    • Types of HCWs
    • Hospital-specific contact precaution practices

• **Outcome measures** - Compliance with individual components of contact isolation precautions during varying burdens of isolation
  – Hand hygiene (HH) before and after patient encounter
  – Donning of gown and gloves upon entering a patient room
  – Doffing of gown and gloves upon exiting
  – Composite compliance (all 5 measures together)
## Results

### BURDEN of ISOLATION

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>% Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>≤ 20%</td>
</tr>
<tr>
<td>HH Pre</td>
<td>37.2</td>
</tr>
<tr>
<td>Gwn</td>
<td>74.3</td>
</tr>
<tr>
<td>Glv</td>
<td>80.1</td>
</tr>
<tr>
<td>Gwn/Glv Doffing</td>
<td>80.1</td>
</tr>
<tr>
<td>HH Post</td>
<td>61.0</td>
</tr>
<tr>
<td>All 5</td>
<td>28.9</td>
</tr>
</tbody>
</table>

- **Isolation Density**
  - 0 - 20%
  - 21 - 40%
  - 41 - 60%
  - ≥ 61%

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[Graph showing compliance across different burden of isolation categories.]
Some Issues

Total HH obs = 1,013
Total Sites = 11
Total Number of months = 9
Total Iso obs/month = 93
HH obs/month per facility = 10
Iso Obs/month per facility <1

And how is this helpful??
### UPMC PUH HH and Isolation Compliance vs Isolation Density

<table>
<thead>
<tr>
<th>Month</th>
<th>HH Compliance</th>
<th>Isolation Compliance</th>
<th>Isolation Density</th>
<th>HH Compliance</th>
<th>Isolation Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-14</td>
<td>99.90%</td>
<td>99.90%</td>
<td>99.87%</td>
<td>99.90%</td>
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<td>Feb-14</td>
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<td>Mar-14</td>
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<td>Apr-13</td>
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<td>May-13</td>
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<tr>
<td>Jun-13</td>
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<td>Jul-13</td>
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<td>Aug-13</td>
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<td>Sep-13</td>
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<td>Oct-13</td>
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<td>Nov-13</td>
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<td>Dec-13</td>
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<td>Jan-14</td>
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<td>Feb-14</td>
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<tr>
<td>Mar-14</td>
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</table>

**Total Isolation Days = 51,378**

**Total Patient Days = 238,327**
Conclusions/Discussion

- Placing 40% of patients under contact precautions represents a tipping point for noncompliance with contact isolation precautions measures in these hospitals.

- **Translation**
  - It is **TOO DAMN HARD** to uphold patient safety measures when there are more people at risk.

**REALLY!!!**

Perhaps they should spend more time and effort on increasing HH compliance before setting out to study effects of other parameters.
Sorry we are VERY Busy Today. Our Parachute Density is >60%

I am afraid we won’t be offering you parachutes.
Conclusions of the Paper

• Providers/IP programs should consider the negative impact of the burden of isolation on compliance with contact isolation precautions when developing infection control policies/practices.
  – We do BUT still expect compliance to be near perfect

• Indiscriminately placing patients in contact precautions might have the adverse effect of decreasing the efficacy of contact isolation precautions in controlling the spread of MDROs.
  – Define Indiscriminately?
  – Efficacy is not decreased in hospitals that practice consistent infection prevention

• Burden of isolation of 40% may represent a tipping point, above which compliance with contact isolation precautions drops significantly.

YIKES!!
Hard to imagine isolation density of 40% but if isolation practices are hard wired density should not result is decreased compliance.
The Infamous Stelfox Study
Safety of Patients Isolated for Infection Control

• Nonrandomized study
• “Adverse events” were higher in patients on CP than those not on CP
  – Absolute terms and adjusted for length of stay.
• A rate of 31 versus 15 adverse events/1000 days was observed in isolated vs nonisolated patients \( (P < .001) \).
• General process of care measures were worse in CP patients.
  – Inappropriate documentation of vital signs \( (14\% \text{ vs } 9\%, \text{ respectively, } P < .001) \)
  – Days without a physician note \( (26\% \text{ vs } 13\%, \text{ respectively, } P < .001) \)
  – Days without a nursing note \( (14\% \text{ vs } 10\%, \text{ respectively, } P < .001) \)
• CHF specific process measures were worse in CP patients.
  – Stress testing \( (14\% \text{ vs } 45\%, \text{ } P < .001) \)
  – Evaluation of left ventricular function \( (57\% \text{ vs } 69\%, \text{ } P = .049) \),

THE STUDY FOUND NO SIGNIFICANT INCREASES IN MORTALITY DIAGNOSTIC, OPERATIVE, ANESTHETIC, MEDICAL PROCEDURE, OR ADVERSE DRUG EVENTS.

Stelfox HT, Bates DW, Redelmeier DA. *JAMA* 2003; 290:1899-1905
Bottom Line

• If neglect of isolated patients is associated with adverse effects
  – Facilities should spend time correcting bad behavior instead of measuring outcomes of this tolerance

• Inexcusable behavior by medical professionals should not be used as justification for avoiding use of effective control measures and allowing, no promoting, transmission of lethal infections.
## What Are Others Doing?

### Table 1. Contact Isolation Practices for Multidrug-Resistant (MDR) Bacteria, Reported by Society for Healthcare Epidemiology of America Research Network Members

<table>
<thead>
<tr>
<th></th>
<th>MRSA</th>
<th>VRE</th>
<th>ESBL-producing bacteria</th>
<th>CRE</th>
<th>MDR&lt;sup&gt;a&lt;/sup&gt; Pseudomonas</th>
<th>MDR&lt;sup&gt;a&lt;/sup&gt; Acinetobacter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolate patients with this organism (n = 66)</td>
<td>93.9</td>
<td>93.9</td>
<td>74.2</td>
<td>93.9</td>
<td>81.8</td>
<td>84.9</td>
</tr>
<tr>
<td>United States (n = 46)</td>
<td>100.0</td>
<td>100.0</td>
<td>87.0</td>
<td>95.7</td>
<td>87.0</td>
<td>89.1</td>
</tr>
<tr>
<td>International (n = 20)</td>
<td>80.0</td>
<td>80.0</td>
<td>45.0</td>
<td>90.0</td>
<td>70.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Duration of isolation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During active illness</td>
<td>6.5</td>
<td>9.7</td>
<td>8.2</td>
<td>6.5</td>
<td>7.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Duration of hospitalization</td>
<td>12.9</td>
<td>11.3</td>
<td>26.5</td>
<td>12.9</td>
<td>27.8</td>
<td>28.6</td>
</tr>
<tr>
<td>Until negative surveillance cultures</td>
<td>64.5</td>
<td>50.0</td>
<td>32.7</td>
<td>29.0</td>
<td>35.2</td>
<td>33.9</td>
</tr>
<tr>
<td>Indefinitely</td>
<td>11.3</td>
<td>24.2</td>
<td>34.7</td>
<td>43.5</td>
<td>31.5</td>
<td>33.9</td>
</tr>
<tr>
<td>How soon cultures may be obtained&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After completion of antibiotics</td>
<td>45.0</td>
<td>54.8</td>
<td>37.5</td>
<td>44.4</td>
<td>42.8</td>
<td>42.1</td>
</tr>
<tr>
<td>After hospital discharge</td>
<td>15.0</td>
<td>19.4</td>
<td>25.0</td>
<td>22.2</td>
<td>14.3</td>
<td>21.1</td>
</tr>
<tr>
<td>&lt;3 months</td>
<td>12.5</td>
<td>19.4</td>
<td>12.5</td>
<td>27.8</td>
<td>28.6</td>
<td>26.3</td>
</tr>
<tr>
<td>≥1 year</td>
<td>7.5</td>
<td>6.5</td>
<td>0.0</td>
<td>5.6</td>
<td>0.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Isolate readmitted patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>77.8</td>
<td>74.6</td>
<td>55.6</td>
<td>72.1</td>
<td>53.2</td>
<td>58.1</td>
</tr>
<tr>
<td>Allow cohorting (n = 66)</td>
<td>54.5</td>
<td>42.4</td>
<td>21.2</td>
<td>18.1</td>
<td>19.7</td>
<td>21.2</td>
</tr>
<tr>
<td>Perform active surveillance in at least one area of hospital (n = 66)</td>
<td>75.8</td>
<td>34.8</td>
<td>18.2</td>
<td>21.2</td>
<td>7.5</td>
<td>15.2</td>
</tr>
</tbody>
</table>

**Note.** Data are % of facilities. CRE, carbapenem-resistant Enterobacteriaceae; ESBL, extended-spectrum β-lactamase; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant enterococci.

<sup>a</sup> As defined by the respondent for isolation/infection control purposes.

<sup>b</sup> If negative surveillance cultures required.
University of Pittsburgh Experience
RESULTS - Sustained MDRO Reduction

VRE HAI Rates

CD HAI Rate

MRSA MICU HAI Rates

\[ \text{VRE HAI Rates} \]

\[ \text{MRSA MICU HAI Rates} \]

\[ \text{CD HAI Rate} \]
Acinetobacter baumanii (ACAT) MDR by Unique Patient at PUH
Jan 2009 to May 2015
Source: Antibiotic Management Program - Clinical Analyst
MRSA Whole House HAI Rates

SUSTAINED REDUCTION

84% reduction
University of Pittsburgh Summary
Annual Estimated Benefits of MRSA Control (02-10)

Avoided MRSA HAI… 87
Lives Saved… 21
Avoided Costs… $3.1M

Sending Patients Home Alive and Well…Priceless!!
Conclusions

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Do MDRO Control Measures work?</td>
<td>YES without question (when done correctly)</td>
</tr>
<tr>
<td>(2) Are Contact precautions necessary to for MDRO control?</td>
<td>YES</td>
</tr>
<tr>
<td>(3) Are patients in contact precautions as safe as other patients?</td>
<td>YES (when not neglected)</td>
</tr>
<tr>
<td>(4) Can we use conclusions of studies without analysis of methods?</td>
<td>OF COURSE NOT</td>
</tr>
</tbody>
</table>
MRDO Prevention

Questions?