Surveillance of Multi-Drug Resistant Organisms

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http://www.unc.edu/depts/spice/
Objectives of Lecture

1. State the current status of MDROs (MRSA, VRE, ESBLs, CRKP)
2. Review risk factors for colonization and infection
3. Describe successful control measures for use in LTCF/RCHE
Goals of MDRO Surveillance

- Quantify burden infection burden and invasive disease from MDROs in LTCF/RCHE
- Monitor trends in MDROs over time to reduce incidence
- Target public health and facility interventions by:
  - Identifying regions / populations with increased incidence of MDROs
  - Monitor changes in antimicrobial susceptibility patterns
Methicillin Resistant *Staph aureus*

- MRSA emerged in the US, UK and Aus, soon after Methicillin became commercially available in the early 1960’s.
- Increased prevalence in the 1970’s moving to more countries.
- By 2000, MRSA accounted for >50% of all *S aureus* clinical isolates from patients with nosocomial infections in the US ICUs (CDC)
The APIC National MRSA Inpatient Survey Results: HA-MRSA vs. CA-MRSA

HA-MRSA (74%)  CA-MRSA* (26%)

*CA-MRSA = diagnosed <48 hours, skin/soft tissue infection, susceptible to clindamycin and Levofloxacin.

Jarvis
The APIC National MRSA Inpatient Survey Results: MRSA Rates By State

[Map showing MRSA rates per state]
Overall MRSA prevalence rate: 46.3 per 1,000 inpatients.

- 34 MRSA infections per 1,000 inpatients.
- 12 MRSA colonizations per 1,000 inpatients.

NC MRSA prevalence rate: 58.3 per 1,000 inpatients
Why Should You Care About Infection Control?

HCWs are the major route of MRSA/VRE Transmission!
Healthcare-Associated Risk Factors Contributing to Infection/colonization in LTCF/RCHE

- Previous MRSA colonization or infection
- Presence of a percutaneous device or indwelling catheter at the time of presentation
- Any of the following within past year:
  - Hospitalization
  - Dialysis
  - Surgery
  - Residence in a long-term care facility

Zack Moore, NCDHHS personal communication
Specific Risk Factors Contributing to MRSA Colonization in LTCF/RCHE

- Poor functional status
- Conditions that cause skin breakdowns (pressure ulcers)
- Antimicrobial therapy
- Nasogastric intubation
- Urinary or fecal incontinence
- Hospitalization within previous 6 months
MRSA

- Can colonize multiple body sites to include anterior nares, skin, GI tract
- Recognized pathogen for hospital and community associated infections
- Intermittent carriage has been demonstrated
- Multiple studies have shown that persons can stay colonized with MRSA for long periods of time, generally months to years
MRSA: Duration of Carriage

- Study conducted in the Netherlands involved 135 patients positive for MRSA upon discharge from the hospital.
- Patients were assessed every 6 months for carriage and MRSA risk factors.
- At 6 months: 121 patients assessed, 60% (72) remained positive.
- At 1 year: 99 patients assessed, 22% (22 patients) remained positive.
- At 2 years: 47 patients assessed, 13% (6) remained positive.

Vriens, MR. Infect Control Hosp Epidemiol 2005; 26: 629-633
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MRSA: Duration of Carriage

- Prospective 10 month study involving 78 patients admitted to a 1200 bed French hospital who were known to have MRSA from a previous admission.

- All were readmitted >3 mo after the end of the previous stay.

- 40% remained positive at time of readmission.

- The median time to a negative MRSA screen was 8.5 mo.

Scanvic A. CID 2001; 32: 1393-98
Kaplan-Meier estimates of time until results of screenings for MRSA became negative for readmitted patients (%)

Scanvic A. CID 2001; 32: 1393-98
Carriage of MRSA in Home Care Setting

Time to MRSA clearance in 148 MRSA carriers admitted to home health then monitored for 1 year.

Estimated mean time to MRSA clearance was 246 days (95% CI, 222-270 days)
Median time was 282 days (95% CI, 233-313 days)

MRSA Colonization Leads to Infection

- Nares cultures on all patients admitted to five units.
- 30/758 (3.96%) patients MRSA-colonized on admission.
- 20% of those MRSA-colonized on admission, and 25% of those acquiring MRSA in the hospital developed MRSA infections compared to 1.5% of those MSSA-colonized or 2% of those not colonized.
- MRSA-colonization increased infection risk compared to MSSA-colonization (RR=9.5) or un-colonized (RR=12).
- Identifying MRSA-colonized patients at admission may benefit from interventions to decrease infection.

Environmental Surveillance

The Environment and its Role in Infection Transmission in Healthcare Facilities –

What Do We Know and What to Do?
What’s in the Environment?
Detection Rate of Multi-resistant Gram-positive (MRSA, VRE) and Gram-negative Bacteria on Different Environmental Items

### Assessing How Often: Population” Studies

Environmental Sampling in MRSA Isolation Rooms (N=25)

<table>
<thead>
<tr>
<th>Factor</th>
<th>No. (%) MRSA positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface sample</td>
<td>269/502 (53.6)</td>
</tr>
<tr>
<td>Bed sample</td>
<td>25/42 (59.5)</td>
</tr>
<tr>
<td>Mattress sample</td>
<td>22/42 (52.4)</td>
</tr>
<tr>
<td>Settle plates</td>
<td>102/251 (40.6)</td>
</tr>
<tr>
<td>Air sample</td>
<td>70/250 (28)</td>
</tr>
<tr>
<td>Identical (or closely related) patient &amp;</td>
<td>14/20 (70)</td>
</tr>
<tr>
<td>environmental isolates</td>
<td></td>
</tr>
</tbody>
</table>

Molecular Characterization of the Transmission between the Colonization of Methicillin-resistant Staphylococcus aureus to Human and Environmental Contamination in Geriatric Long-term Care Wards

% Correlation of Environment to Simultaneous Clinical Isolates, Sept-Oct 1998

<table>
<thead>
<tr>
<th></th>
<th>MRSA (n=42)</th>
<th>MSSA (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identical</td>
<td>62</td>
<td>0</td>
</tr>
<tr>
<td>Close</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Possible</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

Norichika, et al.
 Colonizes intestinal tract

High prevalence among hospitalized patients; 33% of enterococci reported to National Healthcare Safety Network (NHSN) were VRE*

Persons remain colonized for long periods of time, months to years

*Hildron AI, NHSN. Infect Control Hosp Epidemiol ; 2008: 996-1011
VRE and Length of Colonization

- 116 patients hospitalized at the University of Virginia Hospital who were identified with VRE
- F/u cultures obtained on outpatient visits or during hospital stay
- First f/u culture was collected a mean of 125 days after the initial positive isolate
  - After 1st f/u culture: 64% negative
  - After 1st negative f/u culture: 92% negative
  - After 2 negative f/u cultures: 95% remained culture negative
- 22 patients remained persistently colonized for >100 days, including one patient who remained colonized 709 days after the initial isolation

Byers KR. Infect Control Hosp Epidemiol 2002; 23: 207-211
Recurrence of VRE

- 16 patients who had cleared VRE colonization
- 3/16 received no antibiotics during study period and remained VRE negative (f/u cultures obtained an average of 5 mo since initial 3 negatives)
- 13/16 patients received antibiotics during the study period
- 8/13 (62%) developed recurrent VRE
- PFGE suggested that both relapse and acquisition of a new strain occurred

Donskey, MD Infect Control Hosp Epidemiol 2002; 23: 436-440
North Carolina Guidelines for Control of Antibiotic Resistant Organisms Specifically Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant Enterococci (VRE)

North Carolina Statewide Infection Control Program North Carolina General Communicable Disease Control Section Guideline Advisory Group

January 1997
North Carolina Guidelines for Control of Antibiotic Resistant Organisms

(Designed for long-term care facilities and other non-acute care settings)

- Admission to licensed facilities should not be denied or restricted because of colonization or infection with MRSA/VRE.

- Standard Precautions are adequate for nasal or superficial colonization (e.g., identified from sputum culture, but without purulence) with MRSA, or the continent hygienic patient with VRE.
Contact Precautions are indicated for:

- Foley catheter associated MRSA/VRE
- Wounds heavily colonized or infected with MRSA/VRE
- Tracheostomy patients colonized with MRSA/VRE or if infected unable to handle secretions.
CDC Intensified MDRO Control Measures Options

- In acute care settings
  - Implement CP upon room entry
  - Patient placement – single rooms when available

- In LTCFs (RCHE)
  - Use hand hygiene, gloves routinely
  - Implement contact precautions on a case-by-case basis
The 5 C’s for MRSA/VRE (to determine need for CP)

- In LTCFs in US to determine need for Contact Precautions: must have all 5 C’s for Standard Precautions (CDC case-by-case factors)
  - 1. Compliant
  - 2. Competent
  - 2. Continence (urine and stool)
  - 3. No catheter (invasive devices)
  - 4. Colonized
  - 5. Covered and contained wounds
http://www.unc.edu/depts/spice/CA-MRSA.html
Patient Education

Living with MRSA
(Methicillin-Resistant Staphylococcus aureus)

What is MRSA?
Staphylococci or "staph" are bacteria that live on the skin and in the nose, usually without causing harm. Methicillin-resistant Staphylococcus aureus (MRSA) is a type of staph bacteria that has become resistant to antibiotics when a staph bacteria are antibiotics contact staph that is resist

Staph infections are a problem when per
surgical wounds, lacerations, burns, trauma, nosebleeds, or after treatment. However, becoming more o
people who do not have problems, including

What do MRSA bacteria do in wounds, in blood, or in healthy skin? In the skin or other body.

Common sites for MRSA include the nose, hands, and feet. They can sometimes spread to other body parts.

How is MRSA spread?
MRSA bacteria can spread from an infected person to another person during prolonged skin-to-skin contact. MRSA can also be transmitted by an infected person touching commonly shared objects, such as towels, and then transfer to another person who touches the object. MR

Protecting yourself and others from infection

How can you protect yourself and others from infection?

It depends. There are different types of infections to watch for.

Clean your hands often and well

- Regularly clean surfaces and other commonly touched areas (door knobs, light switches, etc.) with a disinfecting wipe.
- Mix one tablespoon bleach to one quart of water. The solution should be made fresh every day.
- Use a mixture of one quart of water and one tablespoon bleach for disinfecting. The solution should be made fresh every day.

Preventing the Spread of MRSA in the Home

How to protect others when you are outside the home: [www.unc.edu/depts/spice/CA-MRSA.html]

Depending on the nature of your infection, there are certain things you can do to help prevent spreading MRSA to others when you are away from home. Be especially careful to keep any infectious material from coming in contact with other people or common surface areas.

People with active MRSA infections in a wound with uncontrollable drainage (either because there is too much drainage or because the wound is not draining normally) should stay home until they are able to completely contain the drainage with bandages.

If you must leave your home, or if you have an active infection that can be completely contained:

- Cover all sores (wounds, boils, etc.) with clean, dry bandages.
- Keep bandages covered with clothing.
- Keep hands covered with clothing.
- Do not share towels, sheets, or any other articles.
- Change your shirt or pants after contact.

Preventing the Spread of MRSA in the Community

MRSA and your Health Care
MRSA/VRE SUMMARY

- MRSA is a continued threat in the Healthcare system (especially hospitalized)
- CA-MRSA is a growing problem in the community
- Environment appears to play a role in transmission
- Increased attention to interventions in healthcare facilities may reduce incidence and prevalence of MRSA
  - Hand hygiene, contact isolation, active surveillance, environmental cleaning
  - Each of these interventions will only be effective if carried out with monitoring and timely feedback
**MDR-Acinetobacter sp.**

- Widely distributed in the environment and can colonize the skin of healthy individuals.

- Studies of healthy military recruits found 17% (17/102) had skin colonization; however, when their isolates were compared to clinical isolates from injured soldiers, none showed genetic similarities*.

- Swab specimens from the nares of 293 healthy soldiers undergoing military training in Texas found no *Acinetobacter* colonization.**

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*Griffith, M. Infect Control Hosp Epidemiol 2006; 27:659-661

**Griffith, M. Infect Control Hosp Epidemiol 2006; 27:787-788
Duration of Carriage

- 140 samples obtained from 30 patients with a remote (> 6 months) history of *Acinetobacter baumannii*

- 5 (17%) has at least one positive surveillance culture

- Length of time from the last clinical isolate ranged from 8-42 months

Marchaim D. *J Clin Micro* 2007; 45: 1551-1555
Surveillance Cultures

- Twenty two patients with recent (<10 days) acinetobacter isolates were considered carriers
- Six body sites sampled with 12 patients having at least 1 positive surveillance culture
- Overall sensitivity of 55%

Marchaim D. J Clin Micro 2007; 45: 1551-1555
Sensitivities of Surveillance Cultures

<table>
<thead>
<tr>
<th>Culture site</th>
<th>No. Patients Sampled</th>
<th>No. with MDR A. baumannii</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surveillance sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nostrils</td>
<td>22</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Pharynx</td>
<td>22</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Skin</td>
<td>22</td>
<td>3</td>
<td>13.5</td>
</tr>
<tr>
<td>Rectum</td>
<td>21</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td><strong>Clinical Sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wounds (only wounds with discharge)</td>
<td>9</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Endotracheal Aspirates</td>
<td>7</td>
<td>2</td>
<td>29</td>
</tr>
</tbody>
</table>

Marchaim D. J Clin Micro 2007; 45: 1551-1555
C. difficile

- Occasionally normal flora, found in ≤ 3% of healthy adults

- Once diarrhea stopped, C. difficile may still be present in stool but the amount excreted in stool and the amount of environmental contamination is reduced
**Clostridium difficile Skin Contamination**

A. Frequency of *C. difficile* contamination of skin sites of 27 patients.

B. Frequency of acquisition on sterile gloves after contact with skin sites of a subset of 10 patients.

C. Typical illustration of acquisition of *C. difficile* on sterile gloves after contact with groin.

Bobulsky GS. *CID*, 2008; 46:447-50
Persistence of Skin Contamination

Kaplan-Meier estimation of time from resolution of diarrhea (day 0) to negative results of culture specimens of abdomen and/or chest skin of patients with C. difficile associated disease.

Bobulsky GS. CID, 2008; 46:447-50
Persistent Shedding of *C. difficile*

Percentage of stool, skin (chest and abdomen), and environmental (bed rail, bedside table, call button, toilet seat) cultures positive for *Clostridium difficile* among 52 patients with *C. difficile* infection.

The number of patients who had samples cultured at each time point were 52 before treatment, 48 on day 3 of treatment, 43 after resolution of diarrhea, 28 at the end of treatment, 22 at 1–2 weeks after treatment, 15 at 3–4 weeks after treatment, and 8 at 5–6 weeks after treatment.

Sethi AK. *Infect Control Hosp Epidemiol*, Jan 2010; 22-27
Recommendation for Discontinuing Isolation at UNC Health Care

- Patient has completed treatment and is no longer symptomatic
  - Room must be terminally cleaned with bleach

- Continue isolation until discharge in settings where routine control measures are not effective and cross-transmission is ongoing. For long term admissions, consider discontinuing isolation 2-4 weeks after treatment ended and symptoms resolved.
Conclusions: Surveillance for MDROs

- MDRO surveillance strategies are used for identifying residents to be placed on additional precautions or when to discontinue isolation. This is a judgment call based upon published guidelines and research, and assessment of patient population.

- Scientific data are insufficient to clearly define when it is appropriate to do surveillance culturing of residents, HCWs or the environment. Additional research is needed to identify and support isolation control measures.

- Our first priority is always to protect other patients and employees.
Thank you