Clinical Research in Antibiotic Resistance

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Associate Hospital Epidemiologist, Staff Physician and Research Health Scientist
Examples of How Antibiotic Resistance Spreads

1. Animals get antibiotics and develop resistant bacteria in their guts.
2. Drug-resistant bacteria can remain on meat from animals. When not handled or cooked properly, the bacteria can spread to humans.
3. Fertilizer or water containing animal feces and drug-resistant bacteria is used on food crops.
4. Drug-resistant bacteria in the animal feces can remain on crops and be eaten. These bacteria can remain in the human gut.
5. George gets antibiotics and develops resistant bacteria in his gut.
6. George stays at home and in the general community. Spreads resistant bacteria.
7. Resistant germs spread directly to other patients or indirectly on unclean hands of healthcare providers.
8. Resistant bacteria spread to other patients from surfaces within the healthcare facility.
9. George gets care at a hospital, nursing home or other inpatient care facility.
10. Patients go home.

David Wallinga, MD Huffington Post
Preventing Multidrug Resistant Organisms (MDRO) Infections

Uncolonized and uninfected

Colonized with or without MDRO infection

Colonized, without infection

Colonized and infected with MDRO

Prevent Transmission and Acquisition

Prevent Development of Infection

= Patient
My Current Research Projects on Preventing MDRO Infections

Colonized with or without MDRO infection → Metagenomics of S. aureus and other MDRO colonization

Uncolonized and uninfected → Colonized with MDRO, without infection → Colonized and infected with MDRO

Transmission of MRSA and other bacteria in healthcare setting

Host Determinants of severity of S. aureus infection
Infectious Disease Fellowship

• Decision points
  – Type of research: clinical research
    • Formal education
  – Research Interest: antibiotic resistance
    • Vancomycin resistant enterococci
    • Cancer center patients

• Lessons learned
  – Write as many papers as you can
  – You will never have this much time again
Assistant Professor

• Decision points
  – Career Development Award- Epidemiology of VRE
    • NIH K23 vs VA
  – Transition to Independent Funding- VA Merit Award
    • R- Gram negative bacteria and *S. aureus*
    • Spinal cord injury patients

• Lessons learned
  – 3 years is not enough for a CDA
  – VRE is a wimp outside of the cancer center
  – Adding organisms isn’t as easy as it sounds
Associate Professor

• Decision points
  – Division Head
    • 5 years
  – Clinical Research Education and Training program

• Lessons learned
  – Don’t take on division head role before you are an established investigator
  – Putting together grants takes more time than writing papers
  – Don’t shy away from administrative jobs you like and that are complementary
Clinical: VA ID Consults (8 weeks/year), 5%

Service: VA Infection Control, EPH APT, SOM APT, Research Career Development...

Research: Gown&Glove in LTC, Microbiome and SA Colonization, 50%

Teaching: CTSI Education, Training and Career Development, 25%

How do I spend my time?
Gown and Glove Study in Community-Based Long Term Care Facilities

Mary-Claire Roghmann, MD, MS for the AHRQ Gown and Glove Study Team
Preventing MDRO Transmission in Healthcare Settings

- Standard Precautions
- Contact Precautions
Standard Precautions
for all patients regardless of diagnosis

• Gloves for contact with
  – blood or any body fluid contaminated with blood
  – urine
  – saliva
  – non-intact skin

• Gowns, masks & goggles for situations in which clothing contamination or splashes may happen
Contact Precautions for patients colonized or infected with MRSA

- Single Room
- Wear gown and gloves to enter the room
- Use the stethoscope in the room
- Remove gloves and gown prior to exiting the room
- Restricted to room except for medically necessary activities
Residents in LTCF cannot be “isolated” like patients in acute care facilities

<table>
<thead>
<tr>
<th>Acute Care</th>
<th>Long-term Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Single room</td>
<td>• Few single rooms; difficult to move patients</td>
</tr>
<tr>
<td>• Contact Precautions</td>
<td>• Residents are encouraged to interact with one another, eat in common areas and share other activities</td>
</tr>
<tr>
<td>– Gloves for walking into room</td>
<td></td>
</tr>
<tr>
<td>– Gowns for touching patient or environment</td>
<td></td>
</tr>
<tr>
<td>• Restricted to room except for medically necessary activities</td>
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</tbody>
</table>
CDC Guidelines: Use of Contact Precautions in Long Term Care Settings

• Decide **whether to implement or whether to modify Contact Precautions** based on
  – the individual patient’s clinical situation
  – prevalence or incidence of MDRO in the facility

• Category II Recommendation
  – Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

HICPAC MDRO Guidelines
Study Objectives

1. to estimate the frequency of MRSA transmission and risk factors for MRSA transmission to disposable gowns and gloves worn by health care workers interacting with nursing home residents

2. to estimate the costs of different modifications to infection control precautions in community based nursing homes
Eligibility

Resident
- Age ≥ 18
- Resident in CB-LCTF
- Expected LOS > 1 week
- Willing to participate
- Written consent
  (speak English, no behavioral issues)

Staff member
- Age ≥ 18
- Staff in LTCF caring for enrolled resident
- Willing to participate
- Verbal consent
  <= 28 days
  6 to 25 usual care interactions

Study Procedures
- Medical history
- Schedule of usual care
- Cultures x1
  - Anterior nares at enrollment
  - Perianal skin at enrollment or during bathing
- Wear study gown and gloves during usual care
- Have type of care recorded
- Have gown and gloves cultured after care

Enrollment

Day 28
Transmission Pathways

Colonized or infected resident

Environment becomes contaminated

Hands or clothing of health care worker

Health care worker carries bacteria to another resident or environment
Enrolled Resident

*S. aureus* Colonization Status

- MRSA: 28%
- MSSA: 15%
- Not MRSA or MSSA: 57%

n = 401
MRSA Transmission to Gloves is higher than Gowns during care of MRSA colonized Residents

- From 954 interactions with 113 residents with MRSA colonization, 24% of gloves and 14% of gowns were contaminated with MRSA. (p<0.01)
Hypotheses

1. Risk of MRSA transmission will vary by type of contact with the resident and each activity will have its own risk of transmission. Some activities such as those involving contact with secretions (e.g. draining wounds, ostomy care) will be of higher risk than others (e.g. vital signs, medications).

2. For any given type of contact, resident characteristics (e.g. being totally dependent upon healthcare personnel for healthcare and activities of daily living) modifies the risk of transmission.
Figure 2: MRSA Transmission to Gowns by common Types of Care observed in MRSA colonized residents

<table>
<thead>
<tr>
<th>Activity</th>
<th>% Gown Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing linens</td>
<td></td>
</tr>
<tr>
<td>Dressing resident</td>
<td></td>
</tr>
<tr>
<td>Transfer of resident</td>
<td></td>
</tr>
<tr>
<td>Hygiene</td>
<td></td>
</tr>
<tr>
<td>Diaper change</td>
<td></td>
</tr>
<tr>
<td>Bathing</td>
<td></td>
</tr>
<tr>
<td>Toilet assist</td>
<td></td>
</tr>
<tr>
<td>Any dressing change</td>
<td></td>
</tr>
<tr>
<td>Physical exam</td>
<td></td>
</tr>
<tr>
<td>Glucose monitoring</td>
<td></td>
</tr>
<tr>
<td>Any device care or use</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
</tr>
<tr>
<td>Showering</td>
<td></td>
</tr>
<tr>
<td>Any medications</td>
<td></td>
</tr>
<tr>
<td>Any therapy</td>
<td></td>
</tr>
<tr>
<td>Any medications ALONE</td>
<td></td>
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<tr>
<td>Feeding</td>
<td></td>
</tr>
<tr>
<td>Any surveillance swab</td>
<td></td>
</tr>
<tr>
<td>Glucose monitoring ALONE</td>
<td></td>
</tr>
</tbody>
</table>

952 observations from 113 residents
Figure 3: MRSA Transmission to Gloves by common Types of Care observed in MRSA colonized residents

- Changing linens
- Dressing resident
- Hygiene
- Bathing
- Diaper change
- Toilet assist
- Transfer of resident
- Physical exam
- Any therapy
- OVERALL
- Any device care or use
- Showering
- Any dressing change
- Any surveillance swab
- Glucose monitoring ALONE
- Any medications
- Any medications ALONE
- Glucose monitoring

950 observations from 113 residents

% Glove Contamination
High Risk Types of Care

Gown Contamination
High risk: OR > 1.0, p < 0.05
• dressing the resident
• transferring the resident
• providing hygiene (brushing teeth, combing hair)
• changing linens
• changing a diaper

Glove Contamination
High risk: OR > 1.0, p < 0.05
• dressing the resident
• providing hygiene (brushing teeth, combing hair)
• changing linens
• changing a diaper

Most healthcare workers do not identify these types of care as ones in which they come into contact with body secretions.
Hypotheses

1. Risk of MRSA transmission will vary by type of contact with the resident and each activity will have its own risk of transmission. Some activities such as those involving contact with secretions (e.g. draining wounds, ostomy care) will be of higher risk than others (e.g. vital signs, medications).

2. For any given type of contact, resident characteristics (e.g. being totally dependent upon healthcare personnel for healthcare and activities of daily living) modifies the risk of transmission.
Potential Resident Characteristics that Increase Transmission

• Heavy Body Secretions
  – Diarrhea (3%)
    • Stool incontinence (18%)
  – Heavy Wound Secretions (1%)
    • Skin breakdown (29%)
      – Pressure ulcer (21%)
  – Heavy respiratory secretions (1%)

• Totally Dependent on HCW for Care (72%)
Figure 4: MRSA Transmission to Gowns by common Types of Care observed in MRSA colonized residents

- Changing linens
- Transfer of resident
- Diaper change
- Dressing resident
- Hygiene
- Bathing
- Toilet assist
- Physical exam
- OVERALL
- Any device care or use
- Any therapy
- Any medications
- Any surveillance swab

952 observations from 113 residents

% Gowns Contamination
Figure 5: MRSA Transmission to Gloves by common Types of Care observed in MRSA colonized residents

Changing linens
Bathing
Hygiene
Transfer of resident
Diaper change
Dressing resident
OVERALL
Any therapy
Any surveillance swab
Toilet assist
Physical exam
Any device care or use
Any medications

950 observations from 113 residents

% Glove Contamination
Main Results

• Gown and glove contamination occurs commonly.
  – Glove (24%) is higher than gown (14%)

• There are high risk and low risk types of care
  – ~same for glove and gown contamination
  – high risk types of care
    • dressing the resident, transferring the resident, providing hygiene (brushing teeth, combing hair), changing linens and diapering the resident
  – low risk types of care
    • meds alone, glucose monitoring alone (gown use only)

• Care of residents with chronic skin breakdown/pressure ulcer has a greater risk of gown and glove contamination.
MRSA Transmission Prevention Strategies

• **Standard Precautions**
  – *G&G Use for types of care involving contact with blood, body fluids, skin breakdown, mucous membranes*
  – *HH for all types of care*

• **Modified Contact Precautions for MRSA colonized residents identified by Active Surveillance + Standard Precautions**
  – *G&G Use for high risk types of care*
  – *HH for all types of care*

• **Modified Contact Precautions for Residents with chronic skin breakdown/pressure ulcers + Standard Precautions**
  – *G&G Use for high risk types of care*
  – *HH for all types of care*

• **Enhance/Redefine Standard Precautions for all Residents**
  – *G&G Use for types of care involving contact with blood, body fluids, skin breakdown, mucous membranes including high risk types of care*
  – *HH for all types of care*
Implications for Infection Control Practice

- The guidelines for Standard Precautions need to be more specific
  - Gowns should be used for dressing the resident, transferring the resident, providing hygiene (brushing teeth, combing hair), changing linens and diapering the resident
  - Care can be done at the same time.
- Residents with chronic skin breakdown have higher risks of MRSA transmission
- Ongoing studies
  - R- Gram negative bacteria transmission
  - C. difficile transmission
  - Stakeholder input through interviews and focus groups
    - Infection Preventionists
    - Administration
    - Healthcare Workers
    - Residents and family members
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