Cross Contamination at the Point of Care

Can it be controlled?

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Presentation Outline

• Hospital Acquired Infections (HAI) are a significant problem
• HAI can be reduced by appropriate procedures
• How can cross contamination occur?
• Case Study : Assisted Monitoring of Blood Glucose
HAI is a Significant Problem

- CDC estimates cost of HAI at $35.7 billion - $45 billion in 2007
- $20,549 – $20,903 per patient

HAI Results in Longer Stays

- Average increase of 19.2 days
- Study suggests increase cost per patient affected of $43,000

Lucado, J, et al. 2010. Adult Hospital Stays with Infections Due to Medical Care, 2007. HCUP Statistical Brief #94. AHRQ.
A question for you…
The importance of prevention

• Study looked at contamination control practices in California
• Wide variation in specific activities - the most focus placed on MRSA.
• Only significant effector seen in lowering rates was the presence in hospital of certified infection control director.

Barrier Precautions Work

- Ecological study assessing the impact of barrier precautions
- Followed the annual incidence rate of acquired *Acinetobacter baumannii* cases in University Hospital of Besançon from 2000 to 2009.
- This study confirms the effectiveness of barrier precautions.

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Surfaces in Hospital Rooms can be Contaminated

- 50 rooms sampled, 10 surfaces each
- 48% (24/50) were positive at 1 or more

Specific:
- Supply carts (10/50, 20%)
- Floors (8/50, 16%),
- Infusion pumps (7/50, 14%)
- Ventilator touch pads (5/44, 11.4%)

Authors conclusion:
“Surfaces often touched by health care workers during routine patient care are commonly contaminated and may be a source of nosocomial spread.”

Thorn, KA, et al. 2011. Environmental contamination because of multidrug-resistant *Acinetobacter baumannii* surrounding colonized or infected patients. *Amer J Infect Control* 39(9):711-715
Organisms can Survive on Surfaces

<table>
<thead>
<tr>
<th>Organism</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most gram(+) bacteria, such as <em>Enterococcus</em> spp. (including VRE), <em>S. aureus</em> (including MRSA), or <em>Streptococcus pyogenes</em></td>
<td>Months</td>
</tr>
<tr>
<td>Many gram(-) species, such as <em>Acinetobacter</em> spp., <em>E. coli</em>, <em>Klebsiella</em> spp., <em>Pseudomonas aeruginosa</em>, <em>Serratia marcescens</em>, or <em>Shigella</em> spp</td>
<td>Months</td>
</tr>
<tr>
<td>Many gram(-) species, such as <em>Bordetella pertussis</em>, <em>Haemophilus influenzae</em>, <em>Proteus vulgaris</em>, or <em>Vibrio cholerae</em></td>
<td>Days</td>
</tr>
<tr>
<td>Yeast</td>
<td>Days - Months</td>
</tr>
<tr>
<td>Respiratory Viruses</td>
<td>Days</td>
</tr>
<tr>
<td>Gastrointestinal Viruses</td>
<td>2 months</td>
</tr>
<tr>
<td>Blood-borne Viruses</td>
<td>Hours - days</td>
</tr>
</tbody>
</table>

A question for you...
Surfaces in Hospital Rooms Can Serve as a Vector of Transmission

## Bacterial Contamination of Uniforms

### Table II  Levels of contamination on uniforms at the start and end of a span of duty

<table>
<thead>
<tr>
<th>Organism</th>
<th>Area</th>
<th>1–10 cfus Before duty</th>
<th>1–10 cfus After duty</th>
<th>10–100 cfus Before duty</th>
<th>10–100 cfus After duty</th>
<th>&gt; 100 cfus Before duty</th>
<th>&gt; 100 cfus After duty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methicillin-resistant</strong></td>
<td>Surgery</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Staphylococcus aureus</strong></td>
<td>Renal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Medicine</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Obstetrics</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Vancomycin-resistant</strong></td>
<td>Surgery</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>enterococci</strong></td>
<td>Renal</td>
<td>10</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Medicine</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Obstetrics</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Clostridium difficile</strong></td>
<td>Surgery</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Renal</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Medicine</td>
<td>3</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Obstetrics</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>17</td>
<td>33</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Healthcare Provider – White Coats

- A cross-sectional study
- 149 grand rounds attendees’ white coats
  - 34 (23%) were contaminated with \textit{S. aureus}, 6 (18%) were MRSA.
  - None of the coats was contaminated with VRE
- Contamination was more prevalent in residents, those working in inpatient settings, and those who saw an inpatient that day
- White coats may be an important vector for patient-to-patient transmission of \textit{S. aureus}

White Coats Out of Laundry

- 29 unwashed hospital operating room scrub swatches analyzed, 23 (79%) were positive for some type of gram-positive cocci
  - 10% of these *S aureus*
  - 69% were positive for coliform bacteria
- Home-laundered scrubs had a significantly higher total bacteria count than hospital-laundered scrubs (P = .016).
- No statistical difference counts between hospital-laundered scrubs and unused new and disposable scrubs.

Other Articles of Interest

- Barbieri, RL. 2008. The hospital has a new dress code for its vectors—er, doctors. *OBG Management* 20(11):6-8
Handwashing

- Hand-hygiene compliance among clinical staff before and after entry was 25%
  - Higher compliance during summer periods (47%)
  - Winter periods (7%)
- More than half of the staff (58%) touched the patient.
- Staff were more likely to clean their hands prior to contact with a patient and sites beside the patient
- Nearly half (48%) handled patient notes and 25% touched the bed.
- Most frequently handled equipment inside room
  - Intravenous drip (30%)
  - Computer (26%)
  - Notes trolley (23%)
  - Blood pressure stand (13%)

Clean Hands Become Contaminated by Patient

- 131 HCW observations
- 103 HCWs whose hand samples were negative for VRE when they entered the room
  - 52% contaminated their hands or gloves after touching the environment
  - 70% contaminated their hands or gloves after touching the patient and the environment

Handwashing

“Hand hygiene is the leading measure for preventing the spread of antimicrobial resistance and reducing healthcare-associated infections (HCAIs), but healthcare worker compliance with optimal practices remains low in most settings.”

Other Handwashing Articles of Interest


Personal Products - Pens

- Study found 100% contamination of pens
- Pathogens:

<table>
<thead>
<tr>
<th>Pathogens isolated</th>
<th>No of colonies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chief</td>
</tr>
<tr>
<td>CNS</td>
<td>29 (5/6)</td>
</tr>
<tr>
<td>MRCNS</td>
<td>81 (6/27)</td>
</tr>
<tr>
<td>Propionibacterium spp</td>
<td>4 (1/9)</td>
</tr>
<tr>
<td>Propionibacterium acnes</td>
<td>12 (1/6)</td>
</tr>
<tr>
<td>Corynebacterium spp</td>
<td>1 (1/6)</td>
</tr>
<tr>
<td>Branhamella catanhalis</td>
<td>5 (2/27)</td>
</tr>
<tr>
<td>Micrococcus spp</td>
<td>2 (2/27)</td>
</tr>
<tr>
<td>Bacillus spp</td>
<td>1 (1/27)</td>
</tr>
<tr>
<td>MR Staphylococcus hemolyticus</td>
<td>2 (1/6)</td>
</tr>
<tr>
<td>Moraxella spp</td>
<td>20 (1/9)</td>
</tr>
<tr>
<td>Streptococcus viridans</td>
<td>30 (3/9)</td>
</tr>
<tr>
<td>Pseudomonas putida</td>
<td>7 (1/27)</td>
</tr>
<tr>
<td>Pseudomonas fluorescens</td>
<td>3 (1/27)</td>
</tr>
<tr>
<td>MR Staphylococcus kohnii</td>
<td>1 (1/27)</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>3 (1/6)</td>
</tr>
<tr>
<td>No pathogen</td>
<td>0 (3/27)</td>
</tr>
</tbody>
</table>

CNS=coagulase-negative staphylococci; MRCNS=methicillin-resistant coagulase-negative staphylococci; MR=methicillin resistant.

Pathogens isolated from writing tools

43.6% of healthcare workers studied had contamination on their cell phones

Table 1. Type of organisms cultured and number and different locations of HCPs

<table>
<thead>
<tr>
<th>Organism</th>
<th>Number (%)</th>
<th>Wards</th>
<th>ER</th>
<th>OPD</th>
<th>OR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td>36 (33)</td>
<td>18</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>36</td>
</tr>
<tr>
<td>MRSA</td>
<td>8 (7.3)</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Staphylococcus epidermidis</td>
<td>25 (22.9)</td>
<td>8</td>
<td>3</td>
<td>12</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>14 (12.8)</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>2 (1.8)</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Acinobacter spp</td>
<td>10 (9.1)</td>
<td>7</td>
<td>1</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Enterococcus spp</td>
<td>10 (9.1)</td>
<td>7</td>
<td>2</td>
<td></td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Streptococcus spp</td>
<td>4 (3.7)</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>21</td>
<td>22</td>
<td>16</td>
<td></td>
<td>109</td>
</tr>
</tbody>
</table>

ER, emergency room; MRSA, methicillin-resistant Staphylococcus aureus; OPD, out patient department; OR, operating room.

Personal Products – Keyboards

- 30 keyboards tested – all were contaminated
  - 6 CFU/key to 430 CFU/key
  - Mold found on 22 keyboards
- Pathogens frequently recovered

Surfaces in Hospital Rooms Can Serve as a Vector of Transmission

A question for you…
Presentation Outline

• HAI is a significant problem
• HAI can be reduced by appropriate procedures
• How can cross contamination occur?
• Case Study: Assisted Monitoring of Blood Glucose
Assisted Monitoring of Blood Glucose

• Term suggested to distinguish AMBG from self-monitoring of blood glucose
• “Evidence from surveys indicates that unsafe AMBG practices may be more widespread than previously recognized.”
• AMBG must become recognized as a practice similar to but distinct from SMBG in order for diabetes testing products to become labeled as intended for use with SMBG or AMBG.
• Additional safety standards should be established for AMBG, including whether, and under what conditions, specific devices may be used or shared.

“Use of glucose meters was associated with a high number of opportunities to transmit infections, and those opportunities were reduced only when glucose meters were assigned to individual patients. Recent guidance from the Centers for Disease Control and Prevention and the US Food and Drug Administration to assign glucose meters to individual persons whenever possible is relevant to inpatient care.”

CDC Guidance

• “Fingerstick devices should never be used for more than one person

• Whenever possible, blood glucose meters should not be shared. If they must be shared, the device should be cleaned and disinfected after every use, per manufacturer’s instructions...how the device should be cleaned and disinfected then it should not be shared.

• Insulin pens and other medication cartridges and syringes are for single-patient-use only and should never be used for more than one person”

“Unused supplies and medications taken to a patient’s bedside during fingerstick monitoring or insulin administration should not be used for another patient because of possible inadvertent contamination.”

Diabetes and Viral Hepatitis: Important Information on Glucose Monitoring
http://www.cdc.gov/hepatitis/Settings/GlucoseMonitoring.htm#section2 accessed 4/20/12
FDA Guidance

• “Lancing devices should never be used for more than one person. Only auto-disabling, single use lancing devices should be used for assisted blood glucose monitoring in multiple patients.

• Point of care blood testing devices such as blood glucose meters should be used only on one patient and not shared. If dedicating blood glucose meters to a single patient is not possible, the meters must be properly cleaned and disinfected after every use following the guidelines provided in device labeling.

• Healthcare personnel should change gloves between patients, even if patient dedicated testing devices and single-use, self-disabling lancing devices are used.”


Accessed 3/11/12
Glucose Test Strips?

- Study looked at contamination in packages of 50 strips (recent switch as cost-saving measure)
- A significant contamination rate observed
- No difference between GTS dedicated to one patient or shared
- Suggested dispensable single units that could be used in a no-touch procedure

Types of Contamination Seen on Glucose Test Strips

Table 1. Frequencies, nature, and quantitative analysis of bacterial contamination of glucose strip tests: n = 148

<table>
<thead>
<tr>
<th>Type of ward</th>
<th>Number of positive culture (%)</th>
<th>Number of positive culture with skin flora (%)*</th>
<th>Number of positive culture with enteric flora (%)†</th>
<th>Range of bacterial load for positive strip (UFC/strip)</th>
<th>Mean bacterial load among positive strip (UFC/strip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SICU</td>
<td>6/36 (16.6)</td>
<td>5/36 (13.9)</td>
<td>1/36 (2.7)</td>
<td>10-20</td>
<td>13</td>
</tr>
<tr>
<td>NICU</td>
<td>21/78 (26.9)</td>
<td>21/78 (26.9)</td>
<td>0</td>
<td>10-50</td>
<td>15</td>
</tr>
<tr>
<td>MGW</td>
<td>5/14 (35.7)</td>
<td>5/14 (35.7)</td>
<td>0</td>
<td>10-190</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>38/148 (25.7)</td>
<td>36/148 (24.3)</td>
<td>2/148 (1.4)</td>
<td>10-280</td>
<td>27</td>
</tr>
</tbody>
</table>

GMW, geriatric medicine ward; HGW, hepatology and gastroenterology wards; NICU, neonatal intensive care unit; SICU, surgical intensive care unit.

*Staphylococcus spp., Corynebacterium spp.
†Enterobacteriaceae, enterococci.

Summary

• HAI is a significant problem
• HAI can be reduced by appropriate procedures
• Barriers, procedures, can minimize cross-contamination from healthcare workers to patients
• Case Study: Assisted Monitoring of Blood Glucose
Thank you for your attention

Scott Sutton, Ph.D.