Impact of On-Demand Molecular Testing on Effective Infection Prevention Programs

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DISCLOSURE

Ms. Spencer is on the Speakers Bureau of Cepheid
Institutional Concern About HAIs?

For Hospital and Health Systems, HAIs Represent Substantial Risk

- Millions of dollars of revenue potentially at risk
- Harm to the institution’s reputation (publicly reported rates)
- Exposure to malpractice liability
- Additional work/tracking for resource-limited infection prevention functions

CMS Quality Incentive Programs: A Carrot and a Stick

Value-Based Purchasing
1.75% of base DRG (goes up to 2% by FY2017)

"Carrot" Credit for Improvement

Value-Based Purchasing
1.75% of inpatient payment (goes up to 2% by FY2017)

HAC
1.0% of inpatient payment

Readmissions
3.0% of inpatient payment

"Stick" Penalty for Poor Performance

HAC: Healthcare-Acquired Conditions
DRG: Diagnosis-Related Group
HACs Are Deadly, Costly, and Generally Not Reimbursed by CMS

Medicare generally refuses to pay the added cost of healthcare acquired conditions (HACs)\(^1\) including:

- Catheter-associated urinary tract infections (CAUTI)
- Surgical site infections
  - Coronary artery bypass grafts
  - Bariatric surgery
  - Certain orthopedic procedures

<table>
<thead>
<tr>
<th>HAI Type</th>
<th>Cost</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical site infections</td>
<td>$21,000</td>
<td>11</td>
</tr>
<tr>
<td>MRSA</td>
<td>$42,000</td>
<td>23</td>
</tr>
<tr>
<td>CLABSI</td>
<td>$46,000</td>
<td>10</td>
</tr>
<tr>
<td>MRSA</td>
<td>$59,000</td>
<td>16</td>
</tr>
<tr>
<td>CAUTI</td>
<td>$900</td>
<td>NR</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>$40,000</td>
<td>13</td>
</tr>
<tr>
<td>Clostridium difficile infections</td>
<td>$11,000</td>
<td>3</td>
</tr>
</tbody>
</table>

LOS = length of stay; CLABSI = central line-associated bloodstream infections; CAUTI = catheter-associated urinary tract infections; NR = not reported.


## Case #1: Presurgical Screening

<table>
<thead>
<tr>
<th>Patient has elective total knee replacement surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture-based pre-surgical screening performed 7 days prior to surgery; patient was colonized with <em>Staphylococcus aureus</em> (MSSA), but not MRSA</td>
</tr>
<tr>
<td>CHG bath ordered for 5 days prior to surgery and nasal mupirocin twice a day</td>
</tr>
<tr>
<td>Patient is admitted to the hospital 3 weeks later with a surgical site infection (MRSA)</td>
</tr>
</tbody>
</table>

CHG = chlorhexidine gluconate
What Went Wrong? Low culture sensitivity missed MRSA – no vancomycin ordered

<table>
<thead>
<tr>
<th>MRSA</th>
<th>Sensitivity(^1)</th>
<th>Specificity(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture with selective media (24-hour test)</td>
<td>62%</td>
<td>99.5%</td>
</tr>
<tr>
<td>Culture with selective media (48-hour test)</td>
<td>78%</td>
<td>98%</td>
</tr>
<tr>
<td>Same-day PCR</td>
<td>98%</td>
<td>98%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MSSA(^2)</th>
<th>MRSA(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bathe with CHG for 5 days prior to surgery</td>
<td>• Bathe with CHG for 5 days prior to surgery</td>
</tr>
<tr>
<td>• Administer intranasal mupirocin decolonization treatment</td>
<td>• Administer intranasal mupirocin decolonization treatment</td>
</tr>
<tr>
<td>• Administer antibiotic prophylaxis (cefazolin)</td>
<td>• Administer antibiotic prophylaxis (cefazolin + vancomycin)</td>
</tr>
</tbody>
</table>

2. Optimizing Pre-Operative Antibiotic Prophylaxis for Cardiac and Orthopedic Procedures Study Protocol (STOP SSIs Project.)
What’s the Impact?

- As a result of this post-surgical complication, the site may be subject to associated reimbursement penalties:
  - Surgical site infection
  - Readmission after total knee replacement
- The average cost of a MRSA surgical site infection is $42,300 and the average length of stay is 23 days
- CMS does not reimburse hospitals for additional costs associated with a surgical site infection following certain orthopedic procedures

One Infection Avoided Can Pay for Over 1200 PCR Tests!

Preventing Surgical Site Infections

- *Staphylococcal aureus* represents 30% of surgical site infections\(^1\)
- Perioperative screening to identify colonization + active decolonization prior can help reduce rates
- On-demand PCR testing has high sensitivity and specificity to ensure the correct organism is identified so appropriate treatment/measures can be administered
- Effective decolonization
  - Nasal decolonization
  - CHG body washes

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Case #2: C. difficile

<table>
<thead>
<tr>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient presented to the ED with chest pain and was diagnosed with acute myocardial infarction</td>
<td></td>
</tr>
<tr>
<td>Underwent coronary artery bypass surgery and given perioperative antibacterial prophylaxis</td>
<td></td>
</tr>
<tr>
<td>After surgery spent 2 days in the surgical ICU and 5 days in a general ward</td>
<td></td>
</tr>
<tr>
<td>Patient discharged</td>
<td></td>
</tr>
<tr>
<td>After 3 days the patient developed diarrhea and was readmitted a week later requiring treatment for C. difficile</td>
<td></td>
</tr>
</tbody>
</table>
What Went Wrong?

- The patient was transferred into a double room on Friday.
- By Friday afternoon, the patient’s roommate developed clinically significant diarrhea; a sample was collected.
- The hospital was tested with EIA and ran PCR to confirm negatives; samples were batched and ran on Mon/Wed/Fri.
- The sample was tested on Monday; positive for *C. difficile*.
- The patient was transferred out of the colonized room so that the roommate could be placed on Special Contact Precautions.
- The patient was exposed to environmental spores, contaminated hands, and equipment leading to CDI.
What Went Wrong? – Delayed diagnosis due to EIA and not PCR

Testing-Related Expenses Represent a Minority of the Overall Cost

Case #2: C. difficile

Value-Based Purchasing
1.75% of Base DRG

• CLABSI
• CAUTI
• SSI [colon/hysterectomy] (2016)
• MRSA bacteremia (2017)
• C. difficile (2017)

All-Cause Readmissions
3.00% of Base DRG

• Acute myocardial infarction
• Heart failure
• Pneumonia
• COPD
• Elective total hip/knee orthopedic surgery

Healthcare-Acquired Conditions Reduction
1.00% of Base DRG

• CLABSI
• CAUTI
• SSI [orthopedic, bariatric, CABG] (2016)
• MRSA bacteremia (2017)
• C. difficile (2017)
Case #3 – Suspect Tuberculosis

- 75-year-old male with a history of asthma was admitted to ED
- Patient was not initially on any type of respiratory precautions due to lack of evidence to suspect infectious respiratory condition
- Transferred to the ICU due to worsening condition on the same day after spending 8 hours in the ED waiting for an ICU bed
- The following day an emergency bronchoscopy was performed and specimen resulted positive for AFB smear; specimen sent for TB testing
- Patient placed on airborne precautions
- List of ED patients and staff – and ICU patients and staff potentially exposed to TB were obtained. Department of Public Health notified of potential TB case
- Anti-TB meds initiated; PPD skin testing started for all exposed patients and staff
Result of TB Test – Revealed *M. avium*

- Airborne precautions discontinued
- Anti-TB drugs discontinued
- DPH and Infection Prevention stopped contacting staff and patients for TB skin testing
- Staff relieved they were not exposed to TB
MTB – On-demand PCR Testing

- Rapid diagnosis of mycobacterium tuberculosis within 2 hours
- If negative – airborne isolation and treatment may be stopped
- Contact lists, TB skin testing, notification of DPH can be stopped
Conclusion

- On-demand rapid diagnostics enhance the efficiency and effectiveness of infection prevention programs

- Rapid diagnosis:
  - Reduces isolation days
  - Reduces unnecessary antimicrobial therapy thereby improving the antimicrobial stewardship program
  - Reduces laboratory processing time with cultures
  - Results in cost avoidance and cost reduction
  - Identifies colonized and infected patients faster for immediate control measures to prevent spread
  - Identifies patients with *Clostridium difficile* on admission compared with batching delays that can result in a HO-CDI Lab ID test in NHSN
  - Quickly distinguishes types of *Mycobacterium* and identifies true MTB in 2 hours