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

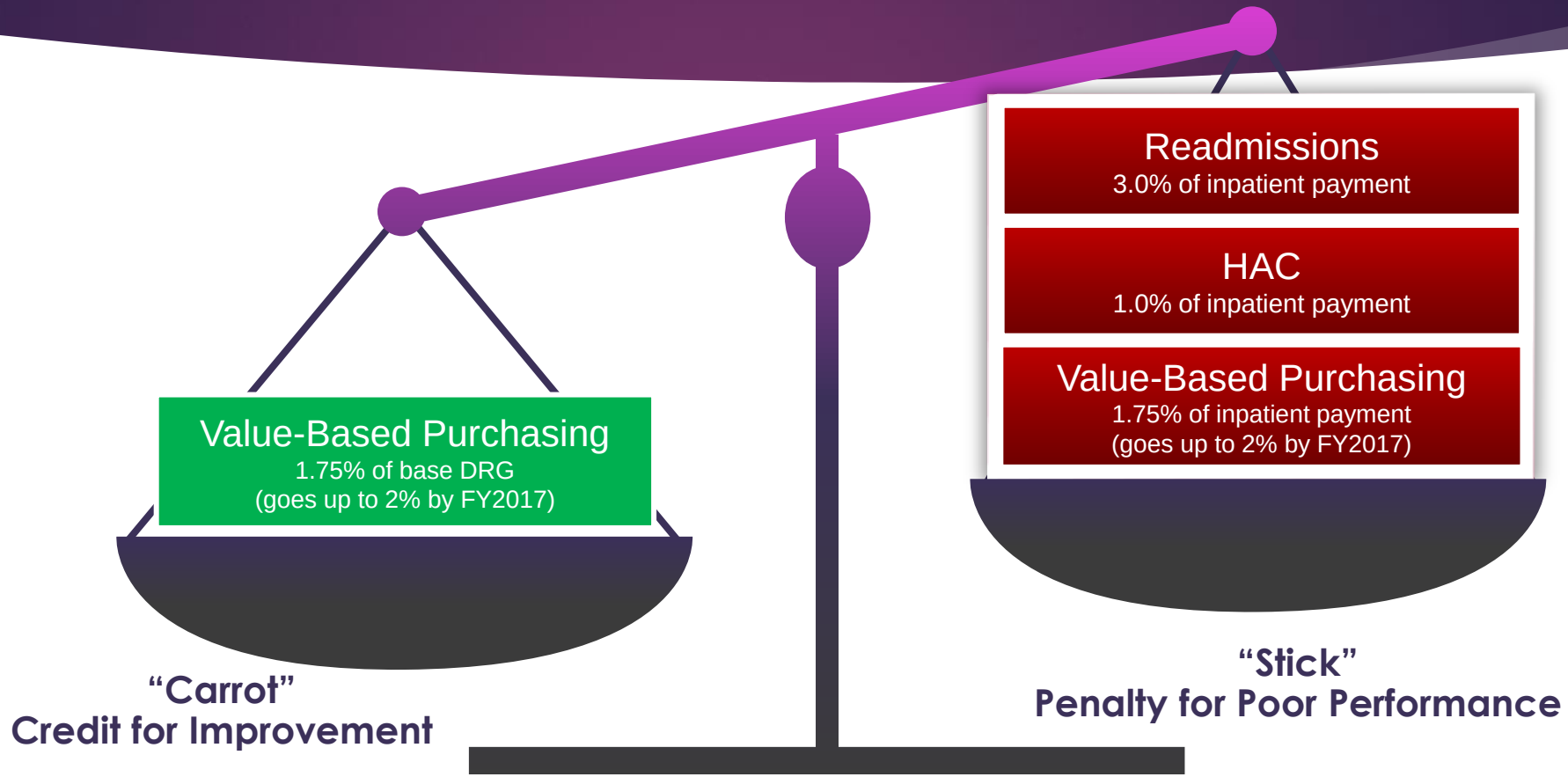
Institutional Concern About HAIs?

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

Boris A. A revenue leak soon turns into flood: how payment penalties for high infection rates could drain hospital finances. http://www.beckershospitalreview.com/finance/a-revenue-leak-soon-turns-to-flood-how-payment-penalties-for-high-infection-rates-could-drain-hospital-finances.html. Accessed November 5, 2015.

CMS Quality Incentive Programs: A Carrot and a Stick



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

HAI Type[2]	Cost	LOS
Surgical site infections	$21,000	11
MRSA	$42,000	23
CLABI	$46,000	10
MRSA	$59,000	16
CAUTI	$900	NR
Ventilator-associated pneumonia	$40,000	13
Clostridium difficile infections	$11,000	3

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

1. Boris A. A revenue leak soon turns into flood: how payment penalties for high infection rates could drain hospital finances. http://www.beckershospitalreview.com/finance/a-revenue-leak-soon-turns-to-flood-how-payment-penalties-for-high-infection-rates-could-drain-hospital-finances.html. Accessed November 5, 2015.
2. Zimlichman E, et al. *JAMA Intern Med*. 2013;(173):2039-46.

Case #1: Presurgical Screening

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

CHG = chlorhexidine gluconate

What Went Wrong? Low culture sensitivity missed MRSA – no vancomycin ordered

MRSA	Sensitivity[1]	Specificity[1]
Culture with selective media (24-hour test)	62%	99.5%
Culture with selective media (48-hour test)	78%	98%
Same-day PCR	98%	98%

MSSA[2]

- Bathe with CHG for 5 days prior to surgery
- Administer intranasal mupirocin decolonization treatment
- Administer antibiotic prophylaxis (cefazolin)

MRSA[2]

- Bathe with CHG for 5 days prior to surgery
- Administer intranasal mupirocin decolonization treatment
- Administer antibiotic prophylaxis (cefazolin + vancomycin)

1. Olchanski N, et al. Infect Control Hosp Epidemiol. 2011;(32):250-7.
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!

Zimlichman E, et al. JAMA Intern Med. 2013;(173):2039-46.

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

1. Sievert DM, at al. Antimicrobial resistant pathogens associated with healthcare associated infections. Summary of data reported to the Centers for Disease Control and Prevention 2009-2010. *Infection Control and Hospital Epidemiology*. 2013;34(1):1-14.


MRSA / MSSA Pre-Surgical Screening
Patient Informed of Pre-Surgical Screening Requirments
Nares Swab Collected for MRSA / MSSA
Specimen transferred to laboratory
Laboratory processes Nares Swab
Results Reported
MRSA - MSSA -
MRSA +
MSSA +
Surgeons Office Notified
Surgeons Office Notified
Surgeons Office Notified
CHG bathing night before and morning of surgery
Patient notified
OR Scheduler notified
Patient notified
Cefazolin at time of surgery
Mupirocin prescribed
CHG bathing x 5 days
Decolonize with intranasal antiseptic x 5 days
Decolonize with intranasal antiseptic x 5 days
CHG bathing x 5 days
Patient compliance check
MRSA Cefazolin plus Vancomycin
Document on patient records
MSSA Cefazolin

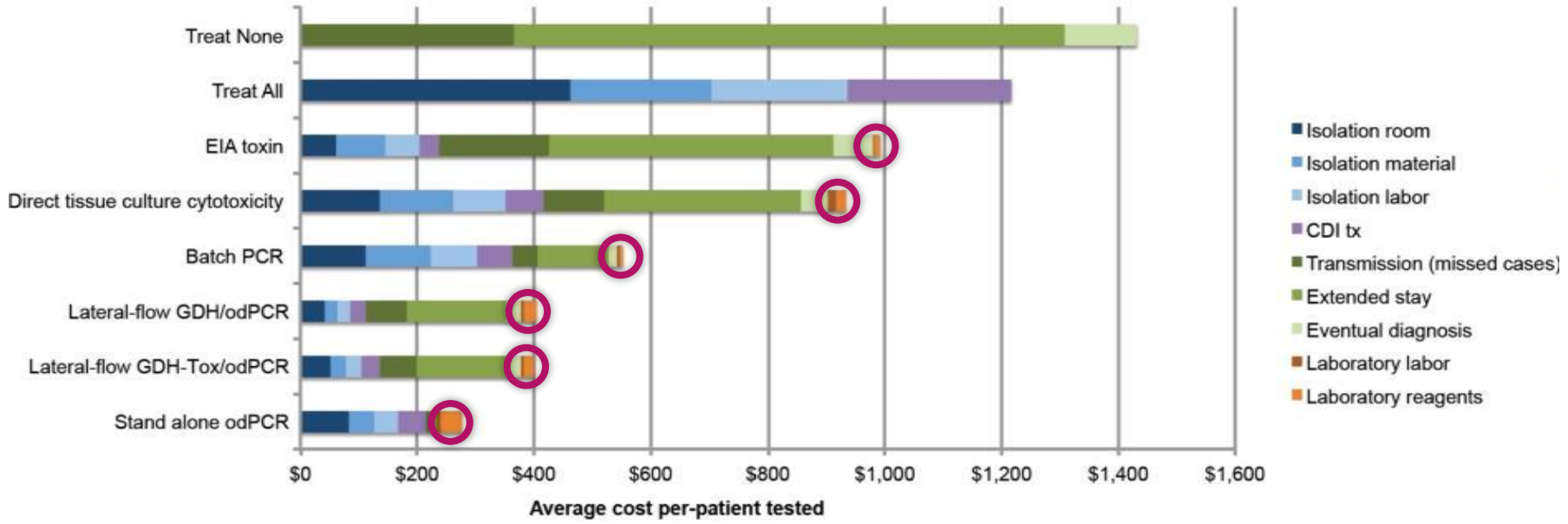
Case #2: C. *difficile*

Patient presented to the ED with chest pain and was diagnosed with acute myocardial infarction
Underwent coronary artery bypass surgery and given perioperative antibacterial prophylaxis
After surgery spent 2 days in the surgical ICU and 5 days in a general ward
Patient discharged
After 3 days the patient developed diarrhea and was readmitted a week later requiring treatment for C. *difficile*

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

Schroeder LF, et al. J Clin Microbiol. 2014;(52):489-96.

Case #2: C. *difficile*

Value-Based Purchasing 1.75% of Base DRG	All-Cause Readmissions 3.00% of Base DRG	Healthcare-Acquired Conditions Reduction 1.00% of Base DRG
• CLABSI	• Acute myocardial infarction	• CLABSI
• CAUTI	• Heart failure	• CAUTI
• SSI [colon/hysterectomy] (2016)	• Pneumonia	• SSI [orthopedic, bariatric, CABG] (2016)
• MRSA bacteremia (2017)	• COPD	• MRSA bacteremia (2017)
• C. *difficile* (2017)	• Elective total hip/knee orthopedic surgery	• C. *difficile* (2017)


ED Patient being Admitted
C. difficile order entered in Cerner
Special contact isolation triggered
Patient placed in isolation
Stool sample collected
Specimen immediately sent to laboratory for processing
Laboratory results within 1 hour
CDI Negative
CDI Positive
Isolation Discontinued and transferred to regular room
Patient transferred to preferable private room and remain isolation for duration of stay
Symptomatic Inpatient
If patient in semi private room
If patient in private room
C. difficile order entered in Cerner
Special contact isolation triggered
Keep patient in semi-private and provide commode
Stool sample collected
Keep patient in special precautions until result available
Specimen immediately sent to laboratory for processing
Laboratory results within 1 hour
CDI Negative
CDI Positive
CDI Negative
CDI Positive
Isolation discontinued and transferred to regular room
Patient transferred to preferable private room and remain isolation for duration of stay
Discontinue isolation
Must remain in special contact for duration of stay

Case #3 – Suspect Tuberculosis

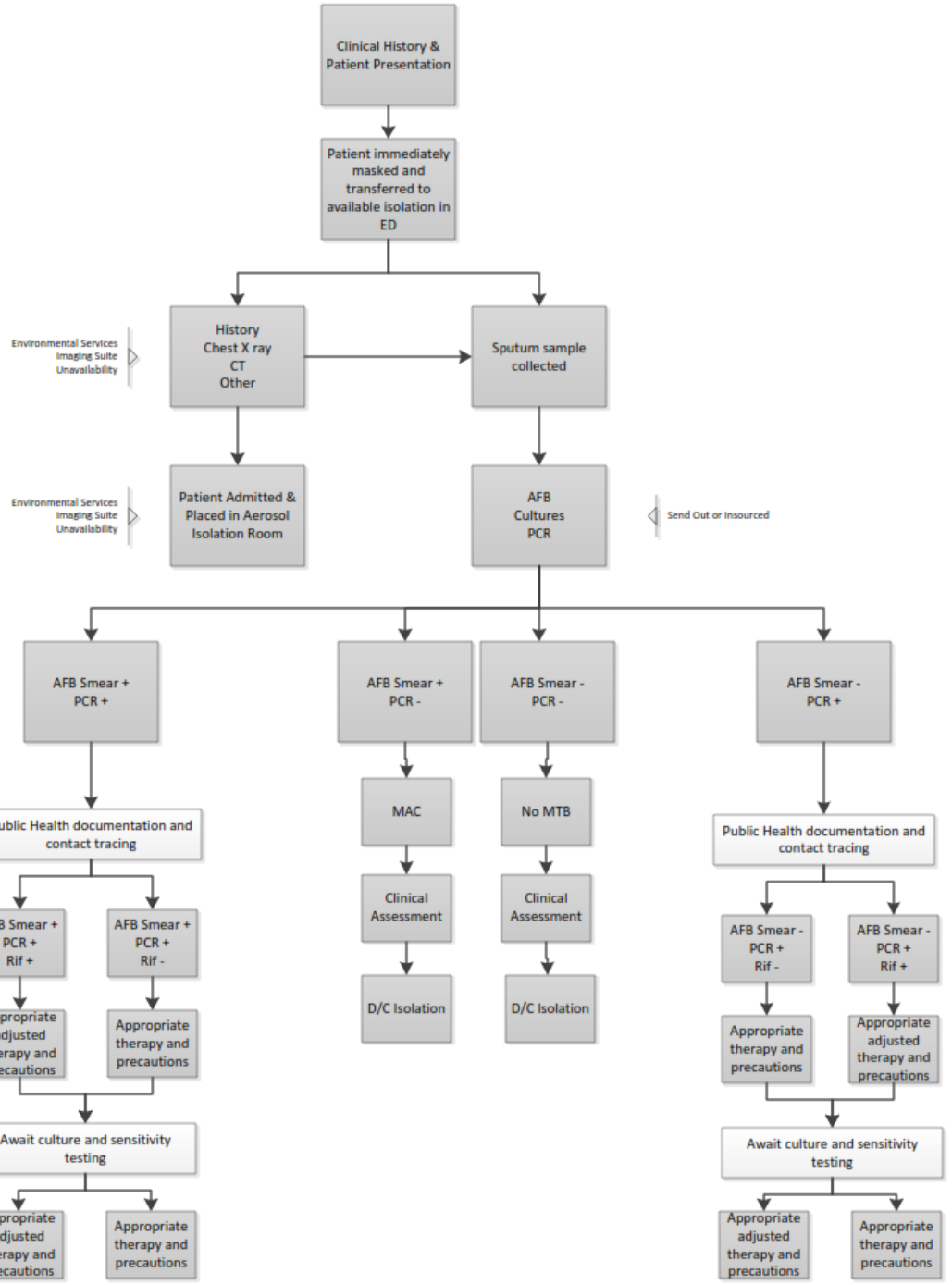
- 75-year-old male with a history of asthma was admitted to ED
- Patient was not initially on any type of respiratory precautions due to lack of evidence to suspect infectious respiratory condition
- Transferred to the ICU due to worsening condition on the same day after spending 8 hours in the ED waiting 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


Clinical History & Patient Presentation
Patient immediately masked and transferred to available isolation in ED
Environmental Services Imaging Suite Unavailability
History Chest X ray CT Other
Sputum sample collected
Environmental Services Imaging Suite Unavailability
Patient Admitted & Placed in Aerosol Isolation Room
AFB Cultures PCR
Send Out or Insourced
AFB Smear + PCR +
AFB Smear + PCR -
AFB Smear - PCR -
AFB Smear - PCR +
Public Health documentation and contact tracing
AFB Smear + PCR + Rif +
AFB Smear + PCR + Rif -
Appropriate adjusted therapy and precautions
Appropriate therapy and precautions
Await culture and sensitivity testing
Appropriate adjusted therapy and precautions
Appropriate therapy and precautions
MAC
Clinical Assessment
D/C Isolation
No MTB
Clinical Assessment
D/C Isolation
Public Health documentation and contact tracing
AFB Smear - PCR + Rif -
AFB Smear - PCR + Rif +
Appropriate therapy and precautions
Appropriate adjusted therapy and precautions
Await culture and sensitivity testing
Appropriate adjusted therapy and precautions
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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