Clinical Impact of Antimicrobial Stewardship and Rapid Diagnostic Tests
Bench to Bedside

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No Conflicts of Interest
This Webinar

- Review the trends in antimicrobial resistance and *C. difficile* infections
- Discuss implementing antimicrobial stewardship strategies in acute care hospitals
- Tackle how to bring rapid diagnostics information from bench to bedside

Will not discuss specific products in detail
Subject to rapid change
Case Scenario

- 25 year old patient with AML admitted for chemotherapy and has a new PICC line
- Prophylactic levofloxacin, acyclovir and fluconazole per protocol
- After a few days becomes neutropenic and febrile
- After 48 hours fevers continue up to 103 with severe chills. Blood cultures reveal a gram negative rod, PICC line is removed and antibiotics changed to a carbapenem
Case Scenario

- On day 4 she is in septic shock, intubated and transferred to MICU
- Blood cultures: multidrug resistant *Pseudomonas*
- You call the lab - organism is resistant to all carbapenems, aminoglycosides and *colistin*

**Which antibiotic would you use next?**
Are we going back to the Pre-antibiotic Era?
Antibiotic resistance—the need for global solutions

- Antimicrobial resistance is a worldwide problem
- Highest in countries with lowest incomes
  - Poor hygiene
  - Contaminated food
  - Polluted water
  - Overcrowding
  - Malnutrition, HIV increase susceptibility to infections

Antibiotics Cause Prolonged Alterations to Gut Flora

Green: susceptible bugs
Purple: resistant

CARBAPENEM-RESISTANT ENTEROBACTERIACEAE

9,000 DRUG-RESISTANT INFECTIONS PER YEAR
600 DEATHS

7,900 CARBAPENEM-RESISTANT KLEBSIELLA SPP.
1,400 CARBAPENEM-RESISTANT E. COLI

CRE HAVE BECOME RESISTANT TO ALL OR NEARLY ALL AVAILABLE ANTIBIOTICS

CDC / DHQP
Aug. 2010

States Reporting KPC-Producing Enterobacteriaceae

http://www.cdc.gov/drugresistance/threat-report-2013/
The Direct Medical Cost of Healthcare-Associated Infections in U.S. Hospitals

Estimated minimum number of illnesses and deaths caused by antibiotic resistance*:

At least 2,049,442 illnesses, 23,000 deaths

* bacteria and fungus included in this report

Hospital Acquired Infections Cost 35-45 billion dollars annually to the US Healthcare System

Scott, D. March 2009 http://www.cdc.gov/HAI/pdfs/hai
http://www.cdc.gov/drugresistance/threat-report-2013/
C. difficile Infections (CDI) Incidence in the US

- CDI rates, deaths and excess healthcare costs in hospitalized patients are at historic highs.
- 400% increase in CDI-related deaths (2000 and 2007).
- 250,000 illnesses and 14,000 deaths.
- More than 90% of deaths occur in people 65 and older.

94% of all CDI are Connected to Getting Medical Care
Magnitude of Antimicrobial Use

- 8.5 billion dollars are spent on antimicrobials annually in the US
- 30-50% of all hospitalized patients receive antibiotics

Table 2. Top 10 Therapeutic Classes by Expenditures for Nonfederal Hospitals

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>2008 Total Expenditure ($ Thousands)</th>
<th>Percent Change From 2007</th>
<th>2009 Expenditure ($ Thousands) (% Total)</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antineoplastic agents</td>
<td>3,344,742</td>
<td>5.0</td>
<td>2,758,485 (13.3)</td>
<td>10.3</td>
</tr>
<tr>
<td>Hemostatic modifiers</td>
<td>3,459,980</td>
<td>6.6</td>
<td>2,732,285 (13.1)</td>
<td>5.4</td>
</tr>
<tr>
<td>Antiinfectives, systemic</td>
<td>3,188,596</td>
<td>7.3</td>
<td>2,396,384 (11.5)</td>
<td>-0.1</td>
</tr>
<tr>
<td>Blood growth factors</td>
<td>2,196,040</td>
<td>-9.6</td>
<td>1,546,527 (7.4)</td>
<td>-7.0</td>
</tr>
<tr>
<td>Hospital solutions</td>
<td>1,697,024</td>
<td>17.5</td>
<td>1,351,909 (6.5)</td>
<td>5.1</td>
</tr>
</tbody>
</table>

American College of Physicians
Global Efforts to Control Antimicrobial Resistance

ANTIMICROBIAL STEWARDSHIP

- Infection Control
- Development of New Drugs
- Improved Diagnostics
- Education
- Research & Public Policy
- Reduce Resistance Reservoirs

We need new antimicrobials!!!

“The development of new antibiotics without having mechanisms to ensure their appropriate use is much like supplying your alcoholic patients with a finer brandy”

Dennis Maki, 1998
Urgency To Expand Antimicrobial Stewardship Efforts

- A greater emphasis is needed on expanding antibiotic stewardship and prevention strategies across the entire spectrum of healthcare delivery

- Collaboration among all healthcare-related organizations and federal, state and public health agencies
The Ideal Antimicrobial Stewardship Program “ASP”

ASP
Infectious Diseases
MD & PharmD

Pharmacy
Microbiology
Information and Technology (IT)
Infection control
Hospital Leadership
Patient Safety
Data analyst

Goals of Antimicrobial Stewardship

- Optimize clinical outcomes
- Minimize Adverse Effects
- Toxicity
- Antimicrobial Resistance
- Cost-Effective Therapy

MacDougall & Polk CMR 2005
Why Stewardship?
Better Clinical Outcomes

AMP = Antibiotic Stewardship Program
UP = Usual Practice

Improved Diagnostics and Stewardship

• Diagnostic uncertainty
  • difficult for clinicians to know when to provide and when to withhold antibiotic treatment

• Time critical results can impact early management of life threatening infections

• 50% of blood cultures may have inadequate volumes of blood (decreased sensitivity)
Surviving Sepsis Campaign
Resuscitation Bundle

Measure serum lactate

Obtain blood cultures prior to antibiotic administration

From the time of presentation, broad-spectrum antibiotics to be given within 1 hour

Source of infection to be identified and drained within 6 hours

In the event of hypotension and/or lactate >4 mmol/L (36 mg/dL):

- deliver an initial minimum of 20 mL/kg of crystalloid (or colloid equivalent)
- give vasopressors for hypotension not responding to initial fluid resuscitation to maintain mean arterial pressure ≥65 mmHg

In the event of persistent arterial hypotension despite volume resuscitation (septic shock) and/or initial lactate >4 mmol/L (36 mg/dL):

- achieve central venous pressure of ≥8 mmHg
- achieve central venous oxygen saturation of ≥70%

Early Appropriate Antibiotic Therapy is The CriticalDeterminant of Survival in Septic Shock

Kumar A, Critical Care Med; 2006: 34, 1589-1596
Inadequate Antibiotic Therapy Increases Mortality

Bringing the bench to be bedside on time
Initiation of Optimal Therapy Using Rapid Testing

Rapid and accurate results on day 1
Supports decisions for appropriate and targeted therapy 1-3 days earlier than conventional methods

Blood draw
Gram stain
Empiric antimicrobial therapy (vancomycin + Gram neg coverage)

Day 0
Day 1
Day 2
Day 3
Day 4

Standard organism identification & antibiotic susceptibility testing
Gram positive/negative broad-spectrum antimicrobial therapy
Targeted antimicrobial therapy

Geiger K, Am J Health Sys Pharm 2012
New Diagnostic Tests

Barriers

- Lab space and equipment cost (owned or leased)
- Cost per test (high vs. poor income countries)
- Technical complexity (time and training)
- How fast is fast enough?
- Send out vs. point of care test
New Diagnostic Tests
Barriers

- Sensitivity and specificity
- Variable performance
  - screening vs. diagnostic
  - symptomatic vs. asymptomatic
  - latent vs. active infection
- Clinicians perceptions and attitudes
  - early vs. late adopters

Benefits are Sometimes Analyzed in “Silos”
Benefits Beyond the Lab

- Patient safety
  - avoiding unnecessary antimicrobials
  - starting timely effective antimicrobial therapy
- Stewardship program (streamlining, escalation or discontinuation)
- Length of stay

Ability to document impact antimicrobial selection, patient outcomes and reduce antimicrobial resistance
Implementation Steps for Rapid Diagnostics and ASP

- Which test fits your hospital needs and budget?
- Clinical microbiologist
- ID/ PharmD Stewardship team on board
- In-house validation
- Reporting and interpretation of test results to the medical staff
Can Healthcare Providers Interpret the Micro Reports?

Clinicians have variable understanding of the microbiology reports and don’t always interpret data correctly.

Yes

No

Case Scenario

Mrs. Gold has ESRD. She presents in dialysis with fevers and chills

Blood cultures are taken and she gets empiric vancomycin

24 hours blood cultures come back 3/3 GPCC

You schedule removal of the catheter and continue vanco

72 hours identified as Methicillin Susceptible Staphylococcus aureus (MSSA)

The nephrologist wants to keep on vancomycin “easier to renally dose” and she already got 3 days..
Better Outcomes for MSSA BSI with β-lactam therapy

- MSSA BSI hemodialysis patients had lower rates of treatment failures (death or recurrent infection) with cefazolin than vancomycin, 31% vs. 13% (OR = 3.5)

- Higher SA BSI mortality (33% vs. 19%, p=.05) and LOS (20 vs. 14 days, p=.05) when appropriate therapy is delayed (Delayed = >44.75 hrs.)

Recognizing the need for rapid therapy optimization

- Treating all GPCC-positive patients with vancomycin therapy is not appropriate
- Timely determination of resistance and susceptibility
- Reporting and communication
- Contamination (CoNS) vs. infection
- Opportunities to discontinue unnecessary antimicrobials
# Rapid Molecular Assays for Gram Positive organisms

<table>
<thead>
<tr>
<th>Organisms/Antimicrobial Resistance Targets</th>
<th>Antimicrobial Stewardship Program References</th>
<th>Detection Time (hrs)</th>
<th>Technology</th>
<th>Manufacturer</th>
<th>FDA Cleared</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus, CoNS</td>
<td>9-11</td>
<td>1.5</td>
<td>PNA FISH</td>
<td>AdvanDx</td>
<td>Yes</td>
<td>S. aureus/CNS PNA FISH</td>
</tr>
<tr>
<td>MSSA, MRSA, CoNS</td>
<td>2</td>
<td></td>
<td>PCR</td>
<td>BD GeneOhm</td>
<td>Yes</td>
<td>BD GeneOhm</td>
</tr>
<tr>
<td>MSSA, MRSA, CoNS, MSSA, MRSA</td>
<td>12, 13</td>
<td>1</td>
<td>PCR</td>
<td>Cepheid</td>
<td>Yes</td>
<td>StaphSR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5</td>
<td>Bacteriophage amplification</td>
<td>MicroPhage</td>
<td>Yes</td>
<td>Xpert MRSA/SA BC</td>
</tr>
<tr>
<td>Staphylococcus aureus, Staphylococcus epidermidis</td>
<td></td>
<td>2.5</td>
<td>Nucleic acid</td>
<td>Nanosphere</td>
<td>Yes</td>
<td>KeyPath MRSA/MSSA Blood Culture</td>
</tr>
<tr>
<td>Enterococcus faecalis, Enterococcus faecium</td>
<td>14</td>
<td>1.5</td>
<td>PNA FISH</td>
<td>AdvanDx</td>
<td>Yes</td>
<td>Enterococcus faecalis/OE PNA FISH</td>
</tr>
</tbody>
</table>

Peptide Nucleic Acid Fluorescence In Situ Hybridization
“PNA FISH”

Synthetic oligonucleotide fluorescence-labeled probes hybridize quickly to specific RNA – Staphylococci, Enterococci, Candida species.
PNA FISH

- Some studies show improved antimicrobial therapy based on results (*E. faecalis* vs. *E. faecium* and candidemia)
- Labor intensive
- Requires skilled technicians
- No susceptibility testing
- Blood culture has to be positive

Polymerase Chain Reaction Methicillin Resistant *Staphylococcus aureus* bacteremia
Optimizing Therapy Shortens Length of Stay Translating to Hospital Cost Savings

<table>
<thead>
<tr>
<th>Study</th>
<th>LOS Reduction</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nguyen DT, et al. J Clin Microbiol. 2010 Mar;48(3):785-90</td>
<td>3 Days (8 to 5; any type of MSSA infection)</td>
<td>Pre-PCR <strong>38.5%</strong> (25/65) patients switched to beta-lactam therapy vs. Post-PCR <strong>61.7%</strong> (58/94) (P = 0.004). “vancomycin use declined from a median of 3 days (range, 1 to 44 days) vs. 1 day (range, 0 to 18 days) in the post-PCR period (P &lt; 0.0001)</td>
</tr>
<tr>
<td>Bauer K, et al. CID 2010:51,:1074-80</td>
<td>6.2 Days (21.5 to 15.3);</td>
<td>Mean time to switch from empiric vancomycin to cefazolin or nafcillin in patients with MSSA was <strong>1.7 days shorter post r-PCR</strong> [rapid MRSA/SA result] (p=.002)</td>
</tr>
</tbody>
</table>

$21,387 actual hospital COST savings per SA BSI patient
Gene Mutations Reported to Affect 4.6% -12.9% of PCR Results False Pos/Neg Results are Possible

- Ottowa
  - MecA ‘Dropouts’
  - 77/103 MSSA called MRSA
  - BDGO MRSA nasal test

- Quebec
  - MecA ‘Dropouts’
  - PCR False Positives
  - Homebrew PCR

- Denmark
  - SCCmec Mutation
  - 12.6% MRSA False Neg
  - BDGO MRSA nasal test

- France
  - MecA ‘Dropouts’
  - PCR False Positives
  - Homebrew PCR

- Tokyo
  - MecA ‘Dropouts’
  - 4.6% False Pos Rate
  - BDGO MRSA nasal test

- Toronto
  - MecA ‘Dropouts’
  - 6.6% False Pos Rate
  - BDGO MRSA nasal test

- Iowa City
  - MecA ‘Dropouts’
  - 7.7% False Pos Rate
  - Cepheid Xpert MRSA nasal test

- Louisville, KY
  - MecA ‘Dropouts’
  - PCR False Positives
  - BDGO MRSA nasal test

- Baltimore, MD
  - MecA ‘Dropouts’
  - PCR False Positives
  - BDGO MRSA nasal test

- Switzerland
  - MecA ‘Dropouts’
  - 12.9% False Pos Rate
  - Cepheid Xpert MRSA nasal test

- Thailand
  - MecA ‘Dropouts’
  - PCR False Positives
  - Homebrew PCR

References:
- Huletsky A et al. JCM 2004 May;42(5):1875-84.
- Stamper PD et al. JCM Feb 2011.
- Blanc DS et al. JCM Jan 2011.
Taqman-based real-time PCR detection of \textit{blaKPC} and \textit{blaNDM-1} in a single reaction from gram-negative bacteria

100\% sensitivity & specificity for detection of NDM-1 and KPC

There are other less common carbapenemases and other mechanisms of carbapenem resistance

MALDI-TOF MS

❖ Matrix laser desorption ionization
time-of-flight mass spectrometry

❖ Rapid and reliable species
identification of bacteria fungi

❖ Testing directly from positive blood
culture bottles decreases the time for
antimicrobial susceptibility testing
results for gram negative bacteremia

Huang A. CID 2013; 57 (9):1237-45
Integrating Rapid Pathogen Identification and Antimicrobial Stewardship Significantly Decreases Hospital Costs

Patient outcomes combining rapid diagnostic testing with real time interpretation and feedback by an ID pharmacist

Length of Stay and Cost Outcomes in Survivors
MALDI-TOF & ASP

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Preintervention Cohort (n = 100)</th>
<th>Intervention Cohort (n = 101)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital length of stay</td>
<td>11.9 ± 9.3</td>
<td>9.3 ± 7.6</td>
<td>.01</td>
</tr>
<tr>
<td>Hospital length of stay after BSI onset</td>
<td>9.9 ± 7.1</td>
<td>8.1 ± 6.4</td>
<td>.01</td>
</tr>
<tr>
<td>ICU length of stay</td>
<td>7.3 ± 8.5</td>
<td>6.3 ± 8.7</td>
<td>.05</td>
</tr>
<tr>
<td>ICU length of stay after BSI onset</td>
<td>6.1 ± 6</td>
<td>4.9 ± 6.7</td>
<td>.09</td>
</tr>
<tr>
<td>Total hospital costs</td>
<td>$45,709 ± $61,806</td>
<td>$26,162 ± $28,996</td>
<td>.009</td>
</tr>
<tr>
<td>MS DRG weight</td>
<td>2.7 ± 2.4</td>
<td>±1.9</td>
<td>54</td>
</tr>
</tbody>
</table>

Abbreviations: BSI, bloodstream infection; ICU, intensive care unit; MS DRG, Medicare Diagnosis-Related Group.

* Values for length of stay outcomes are given as days, mean ± SD. Costs are reported as cost per hospitalization, mean ± SD.

- All-cause 30 day mortality 10.7% pre vs. 5.6% intervention (p= .19)
- Mean costs per survivor were $19,547 less
Multiplex PCR

- Variable costs and sensitivity/specificity depending on the manufacturer
- Can detect multiple pathogens
  - bacterial, fungal and viral platforms
- Rapid turnaround (1-12 hours) depending on the test, might be able to provide organism identification by genus, species and resistance detection
- Some could be used directly from whole blood

Comparison of three different commercial PCR assays for the detection of pathogens in critically ill sepsis patients

- 50 critically ill patients (blood cultures vs. Multiplex PCR)
- PCR may supplement but not replace blood cultures in the diagnosis of septic patients

| Tab. 7 True-/false-positive and true-/false-negative results (blood culture, Sepsitest®, VYOO®, LightCycler® SeptiFast) |
|-------------------------------------------------|-----------------|-----------------|-----------------|
|                                                  | Blood cultures | Sepsitest®      | VYOO®           | LightCycler® SeptiFast |
| Positive results                                 | 13             | 6               | 5               | 7a               |
| True-positive                                    | 8              | 6               | 5               | 5a               |
| False-positive                                   | 5              | 0               | 0               | 3a               |
| Negative results                                 | 37             | 44              | 45              | 43               |
| True-negative                                    | 32             | 37              | 37              | 35               |
| False-negativeb                                  | 5              | 7               | 8               | 8                |

*a In one case, LightCycler® SeptiFast detected two pathogens in one assay (one true- and one false-positive). *b For detection of a non-relevant pathogen.
Rapid Pathogen Identification and Antimicrobial Stewardship Must or Maybe?

- There are benefits in rapid pathogen identification
- Depends on your budget
- Strong antimicrobial stewardship support
- 24/7 real-time interventions by the ASP team
- Will the results be as impressive without an ASP intervention like prospective audit and feedback to prescribers?
Impact of Rapid Identification of Coagulase-Negative Staphylococci in the Absence of Antimicrobial Stewardship Intervention

- No statistically significant differences overall
  - LOS (18.7 vs. 20.9 days) or vancomycin use (4.15 days pre-PNA FISH group vs. 3.51 days post-PNA)

- When implemented without active reporting of results or additional support from an ASP did not reduce LOS or vancomycin use

Holtzman C et al. JCM 2011; 49 (4)
Case Scenario

Mr. Diff, a 74 year old nursing home resident is transferred to the hospital with cough, malaise and a 1 day history of fever

Other patients and staff have similar symptoms at the nursing home

Chest X-Ray is negative

Rapid antigen for influenza A is negative

He is hospitalized and started on cefepime plus azithromycin for “healthcare associated pneumonia”
Case Scenario

- After 2 days he is discharged home on an oral quinolone for 7 more days

- The day after the patient was discharged viral culture came back positive for influenza A

- 2 weeks later he goes to the hospital with high WBC 34,000 and watery diarrhea (>7 BM a day)

- His roommate and 3 more residents at the NH developed severe watery diarrhea 6 days later
Houston.. We have a problem!
What can we learn from this case?

- Rapid influenza testing has good specificity but poor sensitivity
  - Negative test should be backed up by culture or PCR
  - Special attention: elderly, children and immunocompromised

- Not all respiratory infections need antibiotics

- Pathogen identification → infection control measures

- Exposure to antibiotics → C. difficile
<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Setting</th>
<th>Key staff</th>
<th>Intervention</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valiquette L, et al (2007)</td>
<td>683-bed secondary/tertiary care hospital, Quebec, Canada</td>
<td>ID physician, PharmD, infection control</td>
<td>Guidelines for decreasing use of antibiotics associated with C.diff. Education to shorten course of antibiotic therapy based on IDSA guidelines</td>
<td>C. diff incidence decreased 60% between 2003-2006, total and targeted antibiotic consumption decreased 54%</td>
</tr>
<tr>
<td>Muto CA, et al (2007)</td>
<td>834-bed, tertiary care Urban teaching hospital, Pittsburgh, PA, USA</td>
<td>ID physicians</td>
<td>Active surveillance for C. diff, expanded infection control audits (i.e. observing Handwashing), targeted Antimicrobial Restriction ID and pharmacist approval.</td>
<td>Antibiotic use decreased by 41% (2003-2005) (clindamycin 69% and Fluoroquinolones 54%) rate of C. diff infections decreased from 7.2 per 1000 discharges to 4.8 (2001-06).</td>
</tr>
<tr>
<td>Carling, et al (2003)</td>
<td>174-bed, university-affiliated Community teaching hospital conducted during 7 years Boston, MA, USA</td>
<td>ID physician and pharmacist</td>
<td>Emphasis on inappropriate use parenteral antibiotics, Guidelines, pharmacy restrictions and antibiotics detailing with individual Prescriber education.</td>
<td>22% decrease in parenteral antibiotics over 7 years. incidence of C. diff from 2.2 cases per 1,000 patient days to 1.4 cases per 1,000 patient days (p=0.002)</td>
</tr>
</tbody>
</table>

www.cdc.gov/VitalSigns/HAI/
Targeted antibiotic (Abx) consumption and nosocomial Clostridium difficile–associated disease (CDAD)

Case Scenario

- A 74 year old man Nursing Home resident transferred to the hospital with fever and cough
- He is hospitalized and started on pip/tazobactam and vancomycin for “healthcare associated pneumonia”
- 3 days later starts having watery diarrhea (>5 BM)
- Stools sent and EIA for *C. difficile* are negative
- The medical student rotating in your service wants to know if that rules out *C. diff*
- What is your answer?
At this time
There is no perfect test for the diagnosis of CDI
Laboratory Diagnosis of CDI

- Glutamate Dehydrogenase (GDH)
- Toxin A/B tests
- Cell Culture Neutralization Assay (CCNA)
- Toxigenic Culture (Culture and CCNA)
- Stool Culture
- Molecular Based (PCR Or LAMP)

Adapted from Brecher, S. *Tres Difficile* PPT online. Indiana Leadership Conf.
Which Test Should I Use?

Considerations

- Accuracy
- Time to detection
- Prevalence in your population
  - Screening tests followed by confirmatory tests
  - In a low prevalence population, a screening test with a high sensitivity is useful (no/few false negatives)

- Cost
- Ease of use
- Data on this topic is rapidly evolving!

Adapted from Brecher, S. Tres Difficile PPT online. Indiana Leadership Conf.
Laboratory Diagnosis of *Clostridium difficile* Infections: There Is Light at the End of the Colon

- If it ain’t loose, it’s of no use
  - Only test patients with clinically significant diarrhea

- Test 1 stool sample per patient per week
  - unless there are clinically compelling reasons to test another sample

- Do not perform a test of cure

- Do not treat asymptomatic carriers

- Create multidisciplinary “*C.diff* Teams”

Brecher, et al. CID 2013;57(8):1175-81
### C. difficile Results for Different Testing Strategies

<table>
<thead>
<tr>
<th>Assay(s)</th>
<th>Sensitivity %</th>
<th>Specificity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxin A/B alone</td>
<td>32–98.7</td>
<td>84–100</td>
</tr>
<tr>
<td>GDH and toxin A/B EIA</td>
<td>41–92</td>
<td>94–100</td>
</tr>
<tr>
<td>GDH/toxin A/B EIA and molecular</td>
<td>68–100</td>
<td>97–100</td>
</tr>
<tr>
<td>Molecular alone</td>
<td>73–100</td>
<td>91–100</td>
</tr>
</tbody>
</table>
CDI Testing and Laxatives

52/120 (43%) of patients on laxatives or stool softeners within 48 hours of testing for *C. difficile*

32/52 (40%) were negative

These findings suggest that in many cases, clinicians are testing and treating for *C. difficile* without evaluating the clinical situation to determine whether a diagnosis of CDI is plausible.
Perhaps take a pause and at least consider other causes if you don't find active toxin production.
CDI Diagnostic and Treatment Options: Recent References

- Burnham, C-AD & Carroll KC. *Clin Microbiol Rev* 2013; 26: 604-630
- Wilcox, MH. *Clin Microbiol Infect* 2012; 18 (S. 6): 13-20
Are the test results clearly written and easy to understand by a non-microbiologist?
Telephone Notification of Positive *C. difficile* Stool Toxin Results Decreases Time to Ordering of Metronidazole or Oral Vancomycin

Mean time to ordering
3.6 vs. 11.9 hours (p < 0.001)
Time to ordering > 24 hours
2 vs. 7%

The fastest test has little value if the results are not acted upon in a timely fashion.
Take Home Points

1. Antimicrobial resistance is a huge problem and we are all part of the solution
2. Rapid testing provides results several days quicker than traditional culture methods
3. Rapid diagnostics can lead to selection of more appropriate antimicrobial therapy
4. Best diagnostic approach for *C. difficile* is controversial
5. ASPs would likely benefit if processes are in place to communicate this information in a timely manner...
Every Prescriber Can Be an Antimicrobial Steward!
Thank You

www.cdc.gov/getsmtart

Got a BUG?

labbo@med.miami.edu