State Epi Perspective: CIDT

- Clinical vs. public health perspective
- FoodNet perspective
- Unintended consequences: surveillance impact, cluster detection, dual infections, exclusion decisions
- Outbreak utility
Advantages of GI CIDT’s

Clinical Setting

- Rapid test results
- Faster and improved diagnosis
- Assessment of multiple pathogens
- Reduced media needs
- Streamlined workflow
- Does not require trained microbiologist

Public Health

- Faster detection of potential cases
- Assessment of multiple pathogens in outbreak specimens
- Improved detection with molecular testing over culture
- Potential for improved syndromic surveillance
Disadvantages of GI CIDT’s

Clinical Setting

- False positives result in inappropriate care
- No susceptibility results
- Cost
- Specimen limitations (rectal swabs not approved)
- What to do with multiple target positives

Public Health

- Inconsistency among pathogens detected
- Loss of isolate for surveillance
- Not useful in assessing PH interventions
- Shifts the burden of culture to PHLs
- Potential wasted effort with false positives
• Bacterial Enteric Infections Detected by Culture-Independent Diagnostic Tests — FoodNet, United States, 2012–2014
  - Surveillance data, 2012-2013
  - Clinical laboratory survey, 2014
Surveillance Data, 2012-2013

- 38,666 culture-confirmed and positive CIDT reports
  - 33,052 (85.5%) Culture-positive only
  - 3,019 (7.8%) CIDT-pos and culture-pos
  - 1,251 (3.2%) CIDT-pos and culture-neg
  - 1,344 (3.5%) CIDT-pos and no culture

http://www.cdc.gov/mmwr/pdf/wk/mm6409.pdf
### TABLE. Number of culture-confirmed cases and positive culture-independent diagnostic test (CIDT) reports (N = 38,666), by selected pathogens and culture results — FoodNet, United States, 2012–2013

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Culture-positive only</th>
<th>CIDT-positive and culture-positive</th>
<th>Positive CIDT reports</th>
<th>CIDT-positive and culture-negative</th>
<th>CIDT-positive and no culture</th>
<th>Total culture-confirmed infections and positive CIDT reports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. ( % )</td>
<td>No. ( % )</td>
<td>No. ( % )</td>
<td>No. ( % )</td>
<td>No. ( % )</td>
<td>No. ( % )</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>12,894 (83.8)</td>
<td>539 (3.5)</td>
<td>1,099 (7.1)</td>
<td>859 (5.6)</td>
<td>15,391</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>15,034 (98.0)</td>
<td>115 (0.7)</td>
<td>8 (0.1)</td>
<td>185 (1.2)</td>
<td>15,342</td>
<td></td>
</tr>
<tr>
<td>Shigella</td>
<td>4,312 (91.8)</td>
<td>160 (3.4)</td>
<td>27 (0.6)</td>
<td>197 (4.2)</td>
<td>4,696</td>
<td></td>
</tr>
<tr>
<td>STEC*†</td>
<td>34 (1.4)</td>
<td>2,205 (90.3)</td>
<td>110 (4.5)</td>
<td>94 (3.8)</td>
<td>2,443</td>
<td></td>
</tr>
<tr>
<td>Vibrio</td>
<td>446 (98.0)</td>
<td>0 (0.0)</td>
<td>5 (1.1)</td>
<td>4 (0.9)</td>
<td>455</td>
<td></td>
</tr>
<tr>
<td>Yersinia</td>
<td>332 (98.0)</td>
<td>0 (0.0)</td>
<td>2 (0.6)</td>
<td>5 (1.4)</td>
<td>339</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33,052 (85.5)</td>
<td>3,019 (7.8)</td>
<td>1,251 (3.2)</td>
<td>1,344 (3.5)</td>
<td>38,666</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: STEC = Shiga-toxin–producing *Escherichia coli.*

* Excludes 274 Shiga toxin–positive reports from clinical laboratories that were Shiga toxin–negative at a public health laboratory.
† Excludes 53 positive reports of detection of O157 antigen without testing for Shiga toxin.

http://www.cdc.gov/mmwr/pdf/wk/mm6409.pdf
Campy and STEC

- **Campylobacter**
  - 12,894 (83.8%) Culture-positive only
  - 1,099 (7.1%) CIDT-pos and culture-neg

- **STEC**
  - 34 (1.4%) Culture-positive only
  - 2,205 (90.3%) CIDT-pos and culture-pos

http://www.cdc.gov/mmwr/pdf/wk/mm6409.pdf
2015 Year-To-Date: Salmonella and STEC

CIDT-only and Culture-confirmed Cases, Salmonella and STEC, Tennessee 1/1/2015-11/13/2015

- CIDT only
- Culture-confirmed

Graph: Comparison of CIDT-only and Culture-confirmed cases for Salmonella and STEC in Tennessee from 1/1/2015 to 11/13/2015.
### 664 FoodNet Clinical Laboratories...

<table>
<thead>
<tr>
<th>Pathogen tested</th>
<th>Culture only n (%)</th>
<th>CIDT only* n (%)</th>
<th>Culture + CIDT n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>379 (85%)</td>
<td>45 (10%)</td>
<td>22 (5%)</td>
</tr>
<tr>
<td>446 (67%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEC</td>
<td>135 (34%)</td>
<td>73 (19%)</td>
<td>187 (47%)</td>
</tr>
<tr>
<td>395 (60%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only 6 labs reported using CIDT for Salmonella
Tennessee Laboratory Surveys, 2014-2015

Proportion of laboratories reporting CIDT only for onsite diagnostic testing, Tennessee, 2014-2015
Unintended Consequences

- Surveillance impacts:
  - Challenges in monitoring trends
  - Variability in test characteristics may lead to different presentation of result
  - FoodNet surveillance working group
# 2014 Food Safety Progress Report

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Healthy People 2020 Target Rate</th>
<th>2014 Rate*</th>
<th>Change Compared with 2006-2008†</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Campylobacter</em></td>
<td>8.5</td>
<td>13.45</td>
<td>13% increase</td>
</tr>
<tr>
<td>E. coli O157</td>
<td>0.6</td>
<td>0.92</td>
<td>32% decrease</td>
</tr>
<tr>
<td>Listeria</td>
<td>0.2</td>
<td>0.24</td>
<td>No change</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>11.4</td>
<td>15.45</td>
<td>No change</td>
</tr>
<tr>
<td><em>Vibrio</em></td>
<td>0.2</td>
<td>0.45</td>
<td>52% increase</td>
</tr>
<tr>
<td><em>Yersinia</em></td>
<td>0.3</td>
<td>0.28</td>
<td>22% decrease</td>
</tr>
</tbody>
</table>

*Culture-confirmed infections per 100,000 population
† 2006-2008 were the baseline years used to establish Healthy People 2020 targets
Š Shiga toxin-producing *Escherichia coli* O157

For more information, visit [www.cdc.gov/foodnet](http://www.cdc.gov/foodnet)
Unintended Consequences

• Cluster detection: fewer isolates available for PFGE / WGS

• Dual infections:
  – Clostridium difficile

• Exclusion decisions: All positive test results using CIDT should have a follow-up culture for confirmation.
Unintended Consequences

Amy Woron, “If you cant beat ‘em, join ‘em!”

• Early adoption of Biofire platform for outbreak investigations
  – Faster identification of etiology to direct public health actions
  – Novel outbreak pathogens
FilmArray™ Gastrointestinal Panel

1 Test. 22 Targets. All in about an hour.

**Bacteria**
- Campylobacter (jejuni, coli and upsaliensis)
- Clostridium difficile (toxin A/B)
- Plesiomonas shigelloides
- Salmonella
- Yersinia enterocolitica
- *Vibrio* (parahaemolyticus, vulnificus and cholerae)
  - *Vibrio* cholerae
- **Diarrheagenic E. coli/Shigella**
  - Enteroaggregative *E. coli* (EAEC)
  - Enteropathogenic *E. coli* (EPEC)
  - Enterotoxigenic *E. coli* (ETEC) lt/st
  - Shiga-like toxin-producing *E. coli* (STEC) stx1/stx2
    - *E. coli* O157
  - *Shigella/Enteroinvasive E. coli* (EIEC)

**Parasites**
- Cryptosporidium
- Cyclospora cayetanensis
- *Entamoeba histolytica*
- *Giardia lamblia*

**Viruses**
- Adenovirus F 40/41
- Astrovirus
- Norovirus GI/GII
- Rotavirus A
- Sapovirus (I, II, IV and V)
Summary

• Clinicians want faster, wider array of diagnostic testing...CIDT here to stay

• Test characteristics and uptake will influence reporting of trends

• Variety of unintended consequences

• Benefits to public health