CDC Vision for the Future

Christopher R. Braden, M.D.
Division of Foodborne, Waterborne and Environmental Diseases
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention
Where CDC Makes a Difference

- Drive policy and prevention with data and analyses
- Investigate outbreaks to stop them and prevent the next one
- Apply advanced technology and address challenges of culture-independent diagnostic testing (CIDT)
- Support state and local surveillance and response capacity
Number of outbreaks, model-estimated attribution percentages, and 90% credibility intervals, for *Salmonella*, *E. coli* O157, *Campylobacter*, and *Listeria*: United States, 1998-2012

www.cdc.gov/foodsafety/ifsac/events.html
Resistance in 18 pathogens

Burden
2,049,000 illnesses
23,000 deaths

4 of the 18 often transmitted through foods

2 with animal reservoirs
2 with human reservoirs
The FY 2016 Budget requests more than $264 million to support:

- Antibiotic stewardship
- Outbreak surveillance
- Antibiotic use and resistance monitoring
- Research and development related to combating antibiotic resistance
AR Initiative: projected results

AR Initiative could achieve reductions in many infections

Reducing *C. difficile* (healthcare-associated) by 50% would:

- Save **20,000** lives
- Prevent **150,000** hospitalizations
- Cut >**$2 billion** in health care costs
WGS Condenses Lab Workflows
Example: STEC

Current Testing
- Identification
- Serotyping
- PCR virulence profile (4 targets)
- PFGE
- MLVA
- AST

ID and Characterization by WGS
*Listeria* Cluster Metrics Before and After WGS

- **Pre-WGS (Sept 2012–Aug 2013)**
- **WGS Year 1 (Sept 2013–Aug 2014)**
- **WGS Year 2 (Sept 2014–Aug 2015)**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Pre-WGS</th>
<th>WGS Year 1</th>
<th>WGS Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of clusters detected</td>
<td>14</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>No. of clusters detected sooner or only by WGS</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>No. of outbreaks solved (food source identified)</td>
<td>1</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Median no. of cases per cluster</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>No. of cases linked to food source</td>
<td>6</td>
<td>16</td>
<td>93</td>
</tr>
</tbody>
</table>
FDA-CDC Coordinating WGS Support for States

- **FDA GenomeTrakr**
  - Food and environmental pathogens
  - FY2015 funding for 10 state public health or agriculture laboratories
    - Equipment, reagents, personnel (some states)

- **CDC Epidemiology and Laboratory Capacity**
  - Surveillance, outbreak detection and response
  - FY2015 funding for ~20 public health laboratories
    - Reagents

- **Training**
  - Equipment, software, procedures
  - CDC personnel at FDA sponsored training and vice versa
The Challenge
Culture vs. Non-Culture Laboratory Tests

Clinical laboratory

Culture on petri dish

Public health laboratory

PulseNet “fingerprints”

Luminex xTAG GPP

No PulseNet “fingerprints”
Laboratory Strategy to Meet The Challenge of Culture
Independent Diagnostic Methods (CIDT)

1. **Preserve access to cultures**
2. **Prepare for the future working on pure cultures**
3. **Metagenomics No cultures**

**Surveillance by current methods** (serotyping, AST, PFGE, MLVA etc.)

**Surveillance by whole genome sequencing (WGS)**

- 250 STEC genomes study
- 100k Foodborne pathogens sequencing study
- LRN metagenomics study

**Surveillance and diagnostics by metagenomics**

**CIDT Working groups:**
1. Overarching WG
2. Regulatory WG
3. PHL/Funding/Best Practices WG
4. CIDT panel evaluation WG
5. Industry WG

**Communication:**
- White papers, Meetings
- Presentations, Publications

- **Retrospective WGS studies:**
  - *V. cholerae*, *Salmonella*, *Listeria* 
  - *E. coli*, *Campylobacter*

- **Real-time WGS surveillance of listeriosis**
- **Global Microbial Identifier (GMI)**
- **Proof of concept**

- **Bigs.db**
- **Applied Maths, DNASTAR**
Supporting State and Local Capacity

- Epidemiology and Laboratory Capacity
  - Advanced Molecular Detection Initiative
  - FoodCore
  - PulseNet
  - OutbreakNet (enhanced), NORS, NARMS, Cyclospora
  - CaliciNet, NoroSTAT
  - Integrated Food Safety Centers of Excellence

- EHS-Net

- Emerging Infections Program
  - FoodNet

- Cross-cutting programs
  - PHEP, PPHF, Prevention Block Grant
Thank You

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA  30333
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov   Web: http://www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.