PulseNet in Change: Challenges and Opportunities

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Objectives of PulseNet USA remains unchanged

- Detect foodborne disease case *clusters* by PFGE
- Facilitate early identification of common source *outbreaks*
- Assist epidemiologists in investigating *outbreaks*
  - Separate outbreak-associated cases from other sporadic cases
  - Assist in rapidly identifying the source of outbreaks
  - Act as a rapid and effective means of communication between public health laboratories
What could PulseNet do in 2007?

1) Enhance cluster detection
   - Next-generation subtyping methods

2) Enhance support for outbreak investigations
   - Comparison with non-human isolates
   - PulseNet International

3) Support for investigations into sporadic foodborne infections
   - Microbiological attribution analysis
1) Enhance cluster detection

- PFGE slow, costly and laborious
- PulseNet next generation methods
  - MLVA for *E. coli* O157
    - Implemented at CDC and in 4 states
    - Scripts being written for the PulseNet *E. coli* database
  - MLVA for *S. Typhimurium*
    - External validation in PulseNet laboratories
    - To be implemented in PulseNet laboratories
  - MLVA for *S. Enteritidis*
    - Prototype developed by the MN lab*
    - Internal validation at CDC
  - MLVA for *Listeria monocytogenes*
    - Prototype developed by the NC lab
    - Internal validation at CDC
  - SNP analysis for subtyping of *E. coli* O157
    - Developed by CDC

Cluster detection in 10 years (after 2007)

- Combined non-culture diagnosis and subtyping in the clinical, veterinary and food microbiology labs automatically reported to linked public health, FDA and USDA databases
- Automatic cluster detection algorithms
- Automatic comparisons of human and non-human data
Diagnostic Molecular Diagnostic Panels Are Threatening Surveillance

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Laboratory Strategy to Meet The Challenge of Culture
Independent Diagnostic Methods (CIDT)

1. **Preserve cultures**
   - Surveillance by current methods (serotyping, AST, PFGE, MLVA etc.)
   - CIDT Working groups:
     1. Overarching WG
     2. Regulator WG
     3. PHL/Funding/Best Practices WG
     4. CIDT panel evaluation WG
     5. Industry WG
   - Communication:
     White papers, Meetings, Presentations, Publications

2. **Prepare for the future working on pure cultures**
   - Surveillance by whole genome sequencing (WGS)
   - Retrospective WGS studies:
     *V. cholerae, Salmonella, Listeria, E. coli, Campylobacter*
   - Bigs.db
   - 250 STEC genomes study
   - 100k Foodborne pathogens sequencing study
   - LRN metagenomics study

3. **Metagenomics No cultures**
   - Global Microbial Identifier (GMI)
   - Applied Maths, DNASTAR
   - Real-time WGS surveillance of listeriosis
   - Proof of concept

Surveillance and diagnostics by metagenomics
K-mer Based Dendrogram of Illumina Sequenced *Salmonella enterica* ser. Thompson

Cluster Dendrogram

US Outbreak Cluster

Dutch Outbreak

Spurious Samples
Salmonella Saintpaul Pattern JN6X01.0048, Historical and Real Time Outbreak

Jalapeños and Serrano peppers, 1,716 cases

Suspected source: cherry/grape tomatoes, 103 cases
Proof-of-Concept on the Use of Real-Time Whole Genome Sequencing in Conjunction with Enhanced Surveillance for Listeriosis
The PulseNet Web-Portal

Welcome to the T-Cube Web Interface

Please do not click on the Back/Forward/Refresh buttons during the use of this interface.

File loading completed successfully.

Datasets

Run New Screening
Screening Results

Maps
Why will PulseNet be successful in its next decade?

- Clear vision
- Articulated vision in simple terms
  - “PulseNet saves lives”
- Dedicated and loyal co-workers and colleagues
- Partners with a “Can Do” attitude
- Continually reevaluating processes and implemented changes as necessary
  - Software automation
  - New subtyping methods
  - Collaboration from “Farm to Fork”
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Disclaimers:
“The findings and conclusions in this presentation are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention”

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