Using Technology to Enhance Surveillance and Response

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10:30AM
Overview

• Whole genome sequencing
• Florida-specific data pipeline
• GIS
• Social media for complaint detection
  – Twitter
  – Iwaspoisoned.com
• Future enhancements
Whole Genome Sequencing (WGS)

- September 2013
  - WGS *Listeria* Project started
  - *Listeria monocytogenes* genome is small
  - Strong epidemiological data available
  - Labs who perform pulsed-field gel electrophoresis (PFGE) would forward isolates to CDC to sequence isolate
Palm Beach CDC Notification

- January 29, 2015
- CDC notification of five listeriosis cases
  - Identical pulsed-field gel electrophoresis patterns
  - Highly related via whole genome multi-locus sequence typing (wgMLST)
- Review of Listeria Initiative (LI) forms
  - No common brands identified for products, no common grocery stores, restaurants or deli’s noted
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Allele median[min-max] differences at node:

- 3.5[3-5]
- 4[3-9]
Palm Beach Listeriosis Cases, September 2013-November 2014 (n=5)
Summary of Epi Data

• Ages range from 0-86 years, median 80 years
• One case is an infant (illness acquired from mother)
• 60 percent of cases are male
• Two deaths (80 and 86 year old)
• Four LI completed
  – All shopped at different locations of store chain B
  – Consumed ice cream, honeydew, cantaloupe, watermelon and yogurt
• No other commonalities found
What now...

- Pattern and sequencing hasn’t been identified elsewhere nationally
- Monitor
Lab Notification of Matches

• July 31, 2015
• Bureau of Public Health Laboratories in Jacksonville (BPHL) notifies the Food and Waterborne Disease Program (FWDP)
  – Two additional cases that match previous cluster PFGE pattern
  – Notified CDC
    • Request made to determine if this pattern is being reported by any other labs reporting to PulseNet
More Matches

• Two additional listeriosis cases reported
• Both are Palm Beach residents (total of four new cases)
• Interviewed utilizing the LI
• PFGE analysis indicate all same pattern (one specimen discarded by private lab and not submitted for additional analysis)
Palm Beach Listeriosis Cases, September 2013-August 2015 (n=9)
Summary of Epi Data

• Ages range 0-92 years, median of 80 years
• 66.7 percent of cases are male
• Four deaths
• LI utilized to interview new cases and compared to previous interviews
  – Request from CDC to conduct more in-depth interviews
Wham Bam Thank You Ma’am

• Finally a commonality identified.
  – Facility A

• Facility A specific questionnaire developed and administered to all cases in cluster

• Florida Department of Agriculture and Consumer Services notified and joint assessment requested
FDACS Assessment

• Review prior data
  – Surveillance sample – Chicken Salad positive for LM
  – Conduct WGS

• Environmental assessment at facility A conducted

• Environmental sampling conducted
Results
Conclusions

• Strong epidemiological association
• Environmental conditions conducive to the growth and propagation of *Listeria monocytogenes*
• Environmental positives
  – Fire occurred at facility A prior to sampling, equipment used in processing area
GenomeTrakr S1m Phylo Tree
What is GenomeTrakr really up to?
In-House Analysis Advantages

- In-depth Data QC
- Statewide Local Database
- Local Outbreak Cluster Detection
- Shorter Processing Time
- Data Analysis Flexibility
The Hardware

Testing & Development Computer

Everyday work PC

80 TB Hard drive array (~$10,000)

Analytics Computer:
- 128 GB RAM
- Server grade processor (2 Processors, 12 Cores)
- 12.5TB storage (~$5,000)
Florida WGS Data

Listeria monocytogenes
FLAG: 807 Food isolates
FLDOH: 104 Clinical isolates

Escherichia coli
FLAG: 3 Food isolates
FLDOH: 52 Clinical isolates

Salmonella
FLAG: 5 Food isolates
FLDOH: 863 Clinical isolates

GOAL: Real-time addition of FL-DOH clinical samples for a Florida-centric foodborne pathogen database
Florida-Specific WGS Data Pipeline

• FDACS developed analysis pipeline
  – In-house end-to-end analysis of genomic data
• Run in near-real-time
  – Approximately 3 days from sequence to report
• Florida-centric database
  – Contains FDACS data spanning two decades
• Flexible to needs
  – Customizable analysis for specific investigations
• Collaborative
  – Ultimate goal: real-time incorporation of FLDOH data
FDACS WGS Pipeline

• Stage 1: Sequence QC and de novo genome assembly
  – Check for sequence quality, quantity, and purity

• Stage 2: Compare with Florida-centric database
  – Incorporate new data into full dataset, perform reference-free genomic comparison, identify clusters

• Stage 3: Cluster analysis
  – High-quality SNP reference-based analysis performed on potential outbreak clusters to determine relatedness.
  – Accepted cut-off limits *(Listeria monocytogenes)*:
    • ≤20 SNPs = Strain subtypes related, considered a match
    • 20-100 SNPs = Potential link, case-by-case assessment
    • >100 SNPs = Different strain subtypes
What is GIS?

A geographic information system (GIS) lets us visualize, question, analyze, and interpret data to understand relationships, patterns, and trends.

- Cost Savings
- Better Decision Making
- Improved Communication
- Better Record Keeping
From Paper to GIS Technology

September 2016 – Hurricane Hermine FLIRRT activation
From Paper to GIS Technology

September 2016 – Hurricane Hermine FLIRRT activation
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September 2016 – Hurricane Hermine FLIRRT activation
From Paper to GIS Technology

October 2016 – Hurricane Matthew FLIRRT activation
From Paper to GIS Technology

FDACS Food Facilities GIS Map – 47,000 facilities
From Paper to GIS Technology

September 2017 – Hurricane Irma FLIRRT activation
From Paper to GIS Technology

- Assessment should take no longer than 20 minutes per team with form
- Easy way of tracking follow-ups
From Paper to GIS Technology

September 2017 – Hurricane Irma FLIRRT activation
From Paper to GIS Technology

Legend

Retail Food Establishments - Open For Business Status

- YES
- NO
- UNKNOWN

September 2017 – Hurricane Irma FLIRRT activation
From Paper to GIS Technology

State Emergency Response Team: GIS System
Recall Audit Check
Just in Time Training Module

By the end of this training, you should be able to:

- Define product recalls
- Explain classes of recalls
- Explain depth of recalls
- Define a recall audit check
- Prepare for a recall audit check
- Conduct a recall audit check
- Fill out FDA Form 3177
Florida Food Emergencies Webpage

Florida’s Integrated Rapid Response Team (FLIRRT) is a multi-agency coordination group responding to food and food emergency under the Rapid Response Team Food and Drug Administration (FDA) Cooperative Grant Program. Florida is one of 21 states participating in this program, beginning in 2008. Partner agencies include the FDA, the Florida Department of Health, and Florida Department of Business and Professional Regulation.

FLIRRT consists of technical experts in food manufacturing, food inspection, environmental health and epidemiology.

FLIRRT is an active partner in Emergency Support Function 11 (Food and Water) at Florida’s State Emergency Operations Center. In 2016, FLIRRT responded to two natural disaster events: Hurricane Hermine and Hurricane Matthew.

Types of FLIRRT Responses

- Natural Disasters – hurricanes, floods, tornadoes, etc.
- Food recalls
- Foodborne outbreaks
- Intentional food contamination
- Agency exceeds its capability to respond

Program Resources
Partner Agencies Within Florida’s Integrated Rapid Response Team Coordination Group:
- Florida Department of Business and Professional Regulation – Division of Hotels and Restaurants
- Florida Department of Health
- U.S. Food and Drug Administration – Florida District Office

Links for Emergency Information:
- Ice Water Notice [200944 KB]
- Damaged Food Guide [23682 KB]
- Emergency Recovery Guidelines for Food Service Operations [20038 KB]
- Florida State Agricultural Response Team
- Florida State Emergency Operations Center
- Food Defense From Farm to Fork [20018 KB]
- Food and Water Safety During Power Outages and Flooding [200663 KB]
- Hurricane Preparedness
- National RRT Program Fact Sheet [200324 KB]
- Retail Audit Check List and Training

MFRP Alliance
Social Media Complaint Detection

• HealthMap Foodborne Dashboard
• Iwaspoisoned.com
HealthMap Foodborne Dashboard

- Allows public health departments to view potential foodborne illness Twitter complaints within local jurisdiction in real time
- Identifies and captures tweets containing the key words “food poisoning” and geo-locates for validation and response from public health departments
- Geographical border around each region/state
Twitter Surveillance Process

• How it works:
  – Tweet about your foodborne illness
  – We tweet back a link to short survey form
  – We use the data to stop the spread of foodborne illness

• Predefined responses in dashboard (e.g., “Sorry to hear you’re ill”, “Your local PH dept can investigate”, “Report here:”)

Twitter Surveillance Process, cont.

• Responses to complainants in Alabama, Georgia, and Puerto Rico are sent a link to a short survey form
• Responses to Florida complainants are sent a link to Florida’s Food and Waterborne Illness Complaint Form
• Completed forms are sent to respective state via email
Humorous Examples

Me to boss: can't come to work today. Got food poisoning & have been vomiting all night.

Also me:

I cook my chicken by yelling insults at it. I get food poisoning a lot

Eating a yogurt that expired May 29th. If I get food poisoning and die, someone tell my niece, and nephew I love them a lot.
Iwaspoisoned.com

- Consumer-led, crowdsourcing website to monitor food safety incidents and for diners to report suspected food poisoning or bad food experiences
- Collects and screens reports of foodborne illness worldwide
- Real-time information shared with public health departments, restaurants and consumers
- Helps identify and track outbreaks in their earliest stages and supplements existing public health department reporting systems
Contact Information

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