Application of Metagenomic Sequencing to an Outbreak of *E. Coli* O157:H7

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2018 GenomeTrakr Meeting
We are living in a microbial world!
Microbes are everywhere
Beneficial microbes
Pathogenic microbes
Outbreak of *E. coli* O157:H7

Hildale, Utah & Colorado City, Arizona
Outbreak of *E. coli* O157:H7

- Twelve total cases (five from Utah and seven from Arizona)
- Eight hospitalizations, four cases of HUS and two deaths
- Median age of 3 years old
- 143 Environmental samples, three positive for O157:H7
- Difficulty culturing from CIDT specimens
Reference Free WGS Analysis & PFGE

Whole Genome Sequencing and Bioinformatic Analysis of Two Foodborne Illness Outbreaks: Campylobacter jejuni and Salmonella enterica

Kelly F. Oakeson, Jennifer Marie Wagner, Andreas Rohrwasser, Robyn Atkinson-Dunn

Reference Free WGS Analysis & PFGE

No known Hildale, UT association

Maximum Likelihood Tree of 4,467 Concatenated Protein Coding Genes

PFGE First Enzyme Pattern: UTEXH01.678
PFGE Second Enzyme Pattern: UTEXHA26.317

Isolates in blue are from environmental sources
Isolates in black are from clinical sources
Isolates in red are reference sequences

Outbreak Clade

E. coli O157:H7 str. Sakai

0.00016 Substitutions / Site
Culture to CIDT Transition
Shotgun Metagenomics: Analysis

1. DNA Isolation
   - Pellet bacterial cells
   - DNA extraction

2. Library Preparation
   - Nextera XT
   - High Quality Sequence Data

3. Sequence QC
   - SeqyClean
   - High Quality Sequence Data

4. Organism Abundances
   - MetaPhlAn2
   - Community Composition and Abundance

5. Visualization
   - GraPhlAn
   - Various Charts & Graphs
Shotgun Shotgun Metagenomics: Community Composition
Shotgun Metagenomics: Organism Abundance
Shotgun Metagenomics: Analysis

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Shotgun Metagenomics: Genetic Composition
Shotgun Metagenomics: Genetic Composition
Shotgun Metagenomics: Next Steps

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5. Strain Profiling
   - PanPhAn
   - Strain-Level profile and genetic composition

6. De novo Assembly
   - SPAdes/Shovill
   - Draft Genome Assemblies

7. Genome Annotation
   - Prokka
   - Gene Inventories

8. Phylogenetic Analysis
   - Roary & IQ-Tree
   - Phylogenetic Relationships

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Thank You

Utah Public Health Laboratory

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Andy Rohrwasser
Jenni Wagner
Erik Poole
Anna Sangster