



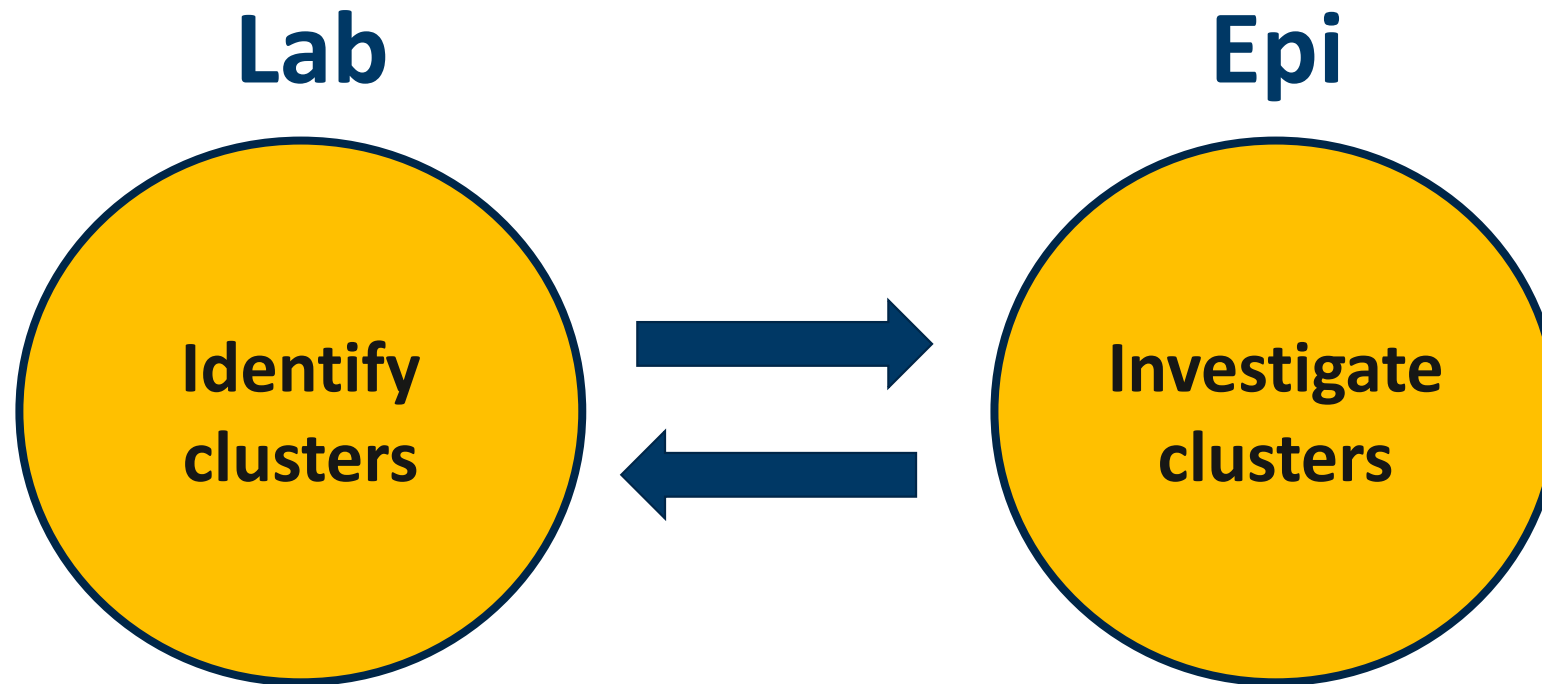
Interpreting, Reporting and Communication of WGS Data

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Enterics Unit Supervisor

March 7, 2019

General Foodborne Surveillance Philosophy



What kinds of analysis are we creating/receiving?

Genomic Characterization

- **Taxonomic ID and serotyping/serogrouping**
 - Kraken, SeqSero, Serotype Finder, srst2
- **Virulence factor and Plasmid detection**
 - ARIBA
- **Antibiotic resistance gene detection**
 - ARIBA

Subtyping and phylogenetic comparisons

- **hqSNP analysis**
 - CDC LyveSet (locally or from CDC)
 - NYSDOH-Wadsworth *Salmonella* Enteritidis and Typhimurium pipeline
 - NCBI Pathogen Detection
- **wgMLST analysis**
 - PulseNet Listeria Pilot lab
 - MentaLiST
- **MLST analysis**
 - stringMLST

How is the data communicated?

Communication Methods

Project initiation

- In-person meetings to discuss:

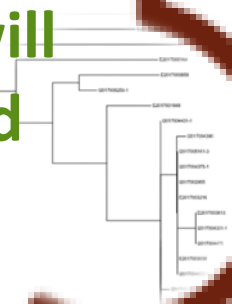
How long will analysis take

What kinds of data can/will analysis provide

What/why samples will be sequenced

How the results will be interpreted

How the results will be formatted and communicated

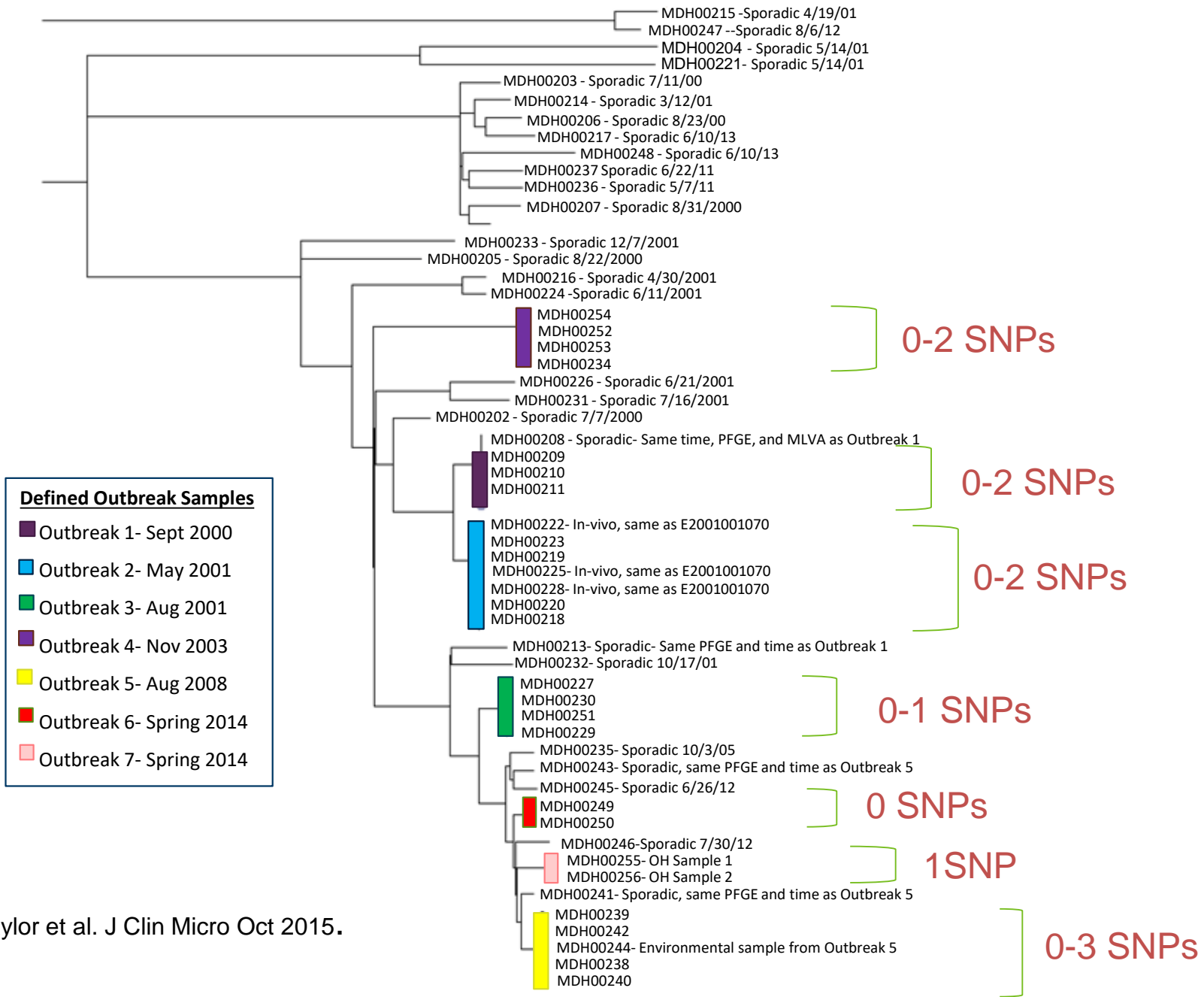


What is a cluster for WGS?

- PFGE-any 2 isolate match within 60 days
- WGS cluster-needs to be determined

Retrospective Outbreaks

- SE-5 OBs, ≤ 3 SNPs within OB
- STM-12 outbreaks analyzed, ≤ 2 SNPs within OB, 1 exception (complicated outbreak)
- Campylobacter
- Exception is emerging Salmonella I 4,5, [12]:i:- associated with porcine exposure clone shows less diversity
- General rule (using LyveSet and NY pipeline) is 0-5 SNPs within 60 days
 - Once a cluster/outbreak is identified, can consider expanding SNP differences and time



Taylor et al. J Clin Micro Oct 2015.

0.05

Retrospective Typhimurium Outbreaks

- Analyzed 12 outbreaks
- 11 OBs differed by ≤ 1 SNP
- Outbreak 12, n=3, 2 isolates 0 SNPs apart, 1 16 SNPs different
 - Melon outbreak
 - Likely increased diversity due to environment/longer outbreak

Campy-White Lily restaurant – Salad, 2002

2002 Confirmed foodborne	salads/cross-contamination	White Lily Restaurant	E2002002685	jejuni
2002 Confirmed foodborne	salads/cross-contamination	White Lily Restaurant	E2002002698	jejuni
2002 Confirmed foodborne	salads/cross-contamination	White Lily Restaurant	E2002002697	jejuni
2002 Confirmed foodborne	salads/cross-contamination	White Lily Restaurant	E2002002742	jejuni

	E2002002697	E2002002698	E2002002685	E2002002742
E2002002697	0			
E2002002698	0	0		
E2002002685	0	0	0	
E2002002742	0	0	0	0

Campy-Chipotle-apple valley, lettuce, 2009

2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009004973	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005362	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005203	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005204	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005263	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009009246	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009006096	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005387	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005525	jejuni
2009 Confirmed Foodborne	lettuce/cross-contamination	Chipotle - apple valley	E2009005524	jejuni

	E2009004973	E2009005203	E2009005204	E2009005263	E2009005362	E2009005387	E2009005524	E2009005525	E2009006096	E2009009246
E2009004973	0									
E2009005203	0	0								
E2009005204	0	0	0							
E2009005263	0	0	0	0						
E2009005362	0	0	0	0	0					
E2009005387	0	0	0	0	0	0				
E2009005524	0	0	0	0	0	0	0			
E2009005525	0	0	0	0	0	0	0	0		
E2009006096	0	0	0	0	0	0	0	0	0	
E2009009246	5804	5741	5288	6152	4971	4869	6003	5587	6240	0

Non-WGS Outbreak #1: Chicken at a Restaurant

July 17, 2018

- Two *Campylobacter jejuni* cases interviewed through routine surveillance**
- Both reported eating a chicken liver pâté dish from a restaurant in Minneapolis with meal dates of June 23 and June 30**
- 3rd case interviewed on July 20 and reported eating a liver pâté dish at the restaurant on July 3**
- Minneapolis Health Department (MHD) notified and investigation initiated**

Not Your Ordinary Chicken Liver Pâté Dish...

**Introducing the Food & Wine Dish of Year
2018: The Paris-Brest at Grand Cafe in
Minneapolis**



EH Investigation

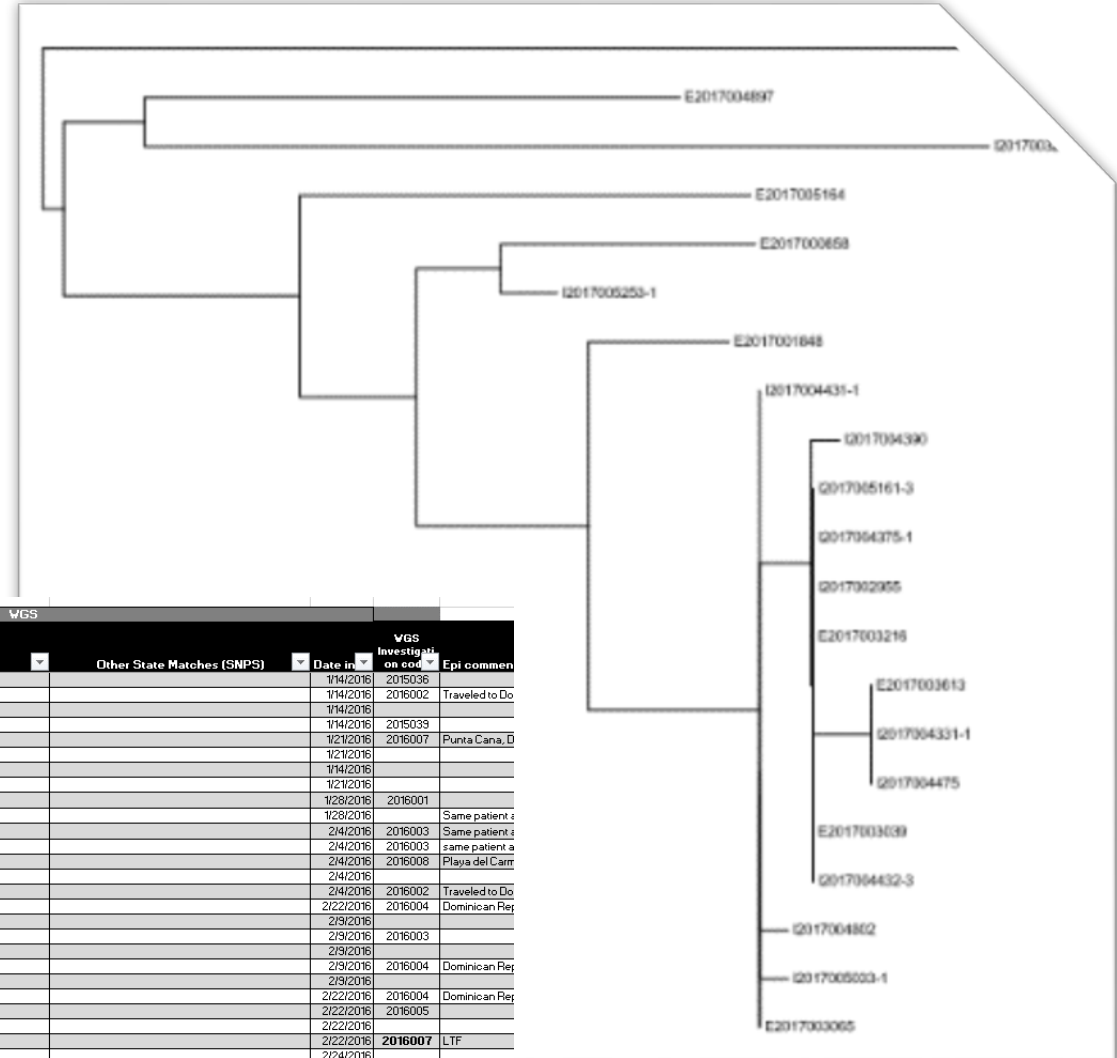
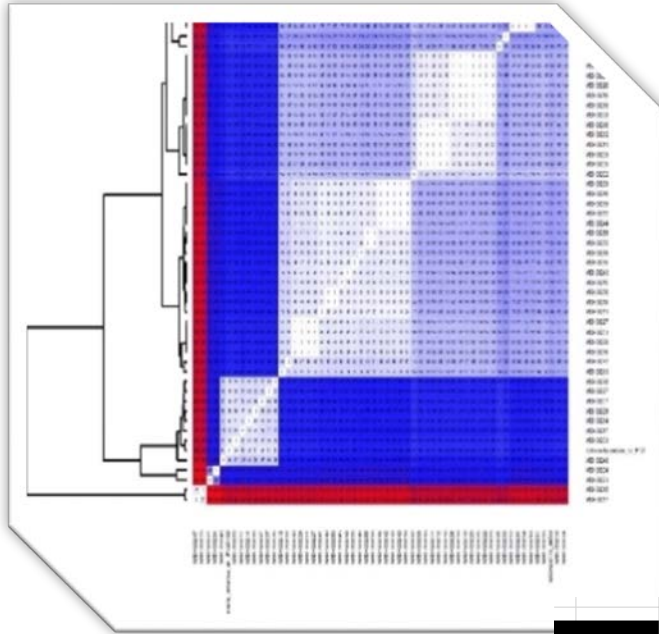
- **No temperatures taken during food prep**
- **Cooked liver measured at 145° F**
- **Restaurant advised not to sell the dish until approved to do so by MHD**

EH Investigation

- **Chefs instructed to take final cooking temperatures and ensure minimum cook temperature of 165° F**
- **Restaurant required to send action plan to MHD showing correction in recipe**
- **Foodborne illness consumer warning printed on restaurant's online menu**

WGS Analysis

- **Isolates from the two cases sequenced and were not closely related to each other (11,706 SNPs apart)**



MDH Acc#	Collection Date	Sequence Date	PFGE		PFGE Cluster	Closest neighbor	Closest MN neighbor(s) (SNPs)	Other State Matches (SNPs)	Date in	Investigation code	Epi comment
			Pattern	Daily Pattern							
950	E2015017856	12/9/2015	11/1/2016	SE11	B116	4	E15-15719, E15-19303 (6) E15-930 (6)		1/14/2016	2016036	
939	E2015018531	12/20/2015	1/11/2016	SE48	B231				1/14/2016	2016002	Traveled to Do
959	E2016000204	12/30/2015	1/11/2016	SE43	B16				1/14/2016		
958	E2016000176	12/31/2015	1/11/2016	SE11	B6	5	E15-17571, E15-14301(5), E15-8119 (5), E15-7968 (5)		1/14/2016	2015039	
964	E2016000287	12/31/2015	1/15/2016	SE11	B6				1/21/2016	2016007	Punta Cana, D
970	E2016000456	12/31/2015	1/15/2016	SE1	B1				1/21/2016		
960	E2016000215	1/1/2016	1/11/2016	SE9	B161	5	E15-6737, E15-5181(6), E15-4475 (6)		1/14/2016		
965	E2016000376	1/3/2016	1/15/2016	SE164	B41				1/21/2016		
977	E2016000740	1/11/2016	1/25/2016	SE164	B214	1	E15-15239		1/28/2016	2016001	
978	E2016000801	1/13/2016	1/25/2016	SE222	B214	2	E15-17439		1/28/2016	2016004	Same patient as
985	E2016001029	1/20/2016	1/29/2016	SE9	B161	0	E16-1099		2/4/2016	2016003	Same patient as
987	E2016001099	1/20/2016	1/29/2016	SE9	B161	0	E16-1029		2/4/2016	2016003	same patient as
988	E2016001120	1/21/2016	1/29/2016	SE19	B116	2	E15-6737, E15-4512 (3), E15-4475 (3)		2/4/2016	2016008	Playa del Carr
986	E2016001071	1/22/2016	1/29/2016	SE11	B116				2/4/2016		
989	E2016001421	1/24/2016	1/29/2016	SE48	B231	2	E15-18531		2/4/2016	2016002	Traveled to Do
101	E2016001531	1/25/2016	2/12/2016	SE11	B6	2	E16-1746, E16-1533		2/22/2016	2016004	Dominican Rep
996	E2016001474	1/28/2016	2/5/2016	SE11	B161	0	MDH-2014-00857		2/9/2016		
997	E2016001477	1/28/2016	2/5/2016	SE9	B161	2	E16-1023(2), E16-1099(2)		2/9/2016	2016003	
998	E2016001504	1/28/2016	2/5/2016	SE43	B16	0	E16-204 (0)		2/9/2016		
999	E2016001533	1/27/2016	2/5/2016	SE11	B6				2/9/2016	2016004	Dominican Rep
100	E2016001566	1/29/2016	2/5/2016	SE43	B72	0	E15-12170 (0), E14-14938 (1)		2/9/2016		
114	E2016001746	1/29/2016	2/12/2016	SE11	B6	2	E16-1533, E16-1531		2/22/2016	2016004	Dominican Rep
102	E2016001727	1/30/2016	2/12/2016	SE11	B116				2/22/2016	2016005	
116	E2016001974	2/1/2016	2/12/2016	SE1	B1				2/22/2016		
104	E2016001927	2/4/2016	2/12/2016	SE11	B6	2	E16-287		2/22/2016	2016007	LTF
125	E2016002209	2/8/2016	2/19/2016	SE43	B72	3	E15-14909		2/24/2016		
128	E2016002162	2/9/2016	2/19/2016	SE11	B78	1	E16-1746, E16-1531, E16-2268 (2), E16-1533 (3)		2/24/2016	2016004	Dominican Rep
127	E2016002341	2/10/2016	2/22/2016	SE11	B116	2	E15-6737, E15-4475, E15-4250, E15-5181(4), E15-5672 (4)		2/25/2016	2016008	Playa del Carr
124	E2016002268	2/12/2016	2/19/2016	SE11	B6	1	E16-1531, E16-2162(2), E16-1746 (2), E16-1533 (3)		2/24/2016	2016004	Dominican Rep



Thu 5/11/2017 1:23 PM

MN_MDH_PFGE

SE WGS Clusters- 5.11.17

To ■ Boxrud, Dave (MDH); ■ Decuir, Marijke (MDH); ■ Eikmeier, Dana (MDH); ■ Klumb, Carrie (MDH); ■ Lappi, Victoria (MDH); ■ Medus, Carlota (MDH); ■ Meyer, Stephanie (MDH); ■ Robinson, Trisha (MDH)

Retention Policy AllMail_90 (90 days)

Expires 8/9/2017

Cluster 2017001: 2 new isolates are 1-5 SNPs from others in the cluster. Now 8 isolates total. ([Marijke](#), SE11B6)

[E2017005289](#)

[E2017004460](#)

Cluster 2017008: 2 new isolates are 1-5 SNPs from others in the cluster. Now 4 isolates total. (SE11B116)

[I2017005940-1](#)

[E2017003821](#)

Cluster 2017010: 1 new isolate is 0 SNPs from others in the cluster. Now 3 isolates total. (SE11B6)

[E2017006068](#)

NEW Cluster 2017013: 2 isolates are 0 SNPs from each other.

[E2017003849 \(SE235B78\)](#)

[E2017005056 \(SE181B93\)](#)

NEW Cluster 2017014: 2 isolates are 0 SNPs from each other. (SE9B161)

[E2017004452](#)

[E2017004814](#)

NEW Cluster 2017015: 2 isolates are 0 SNPs from each other. (SE11B6)

[I2017005906-1](#)

[E2017006005](#)



DEPARTMENT OF HEALTH

cgMLST

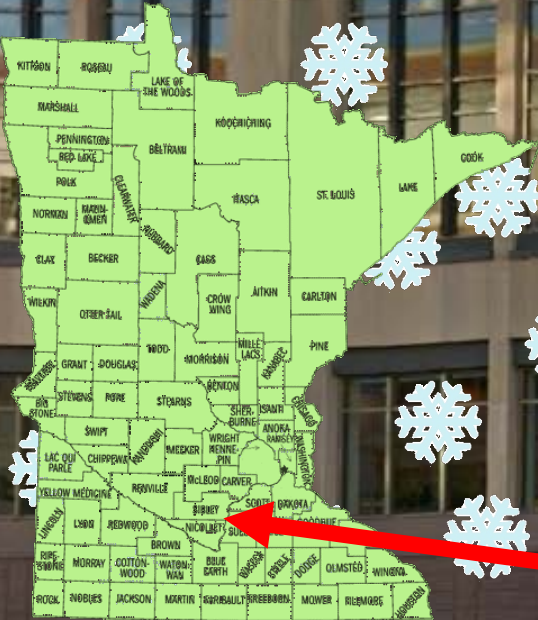
610 Robert St N
St Paul, Minnesota



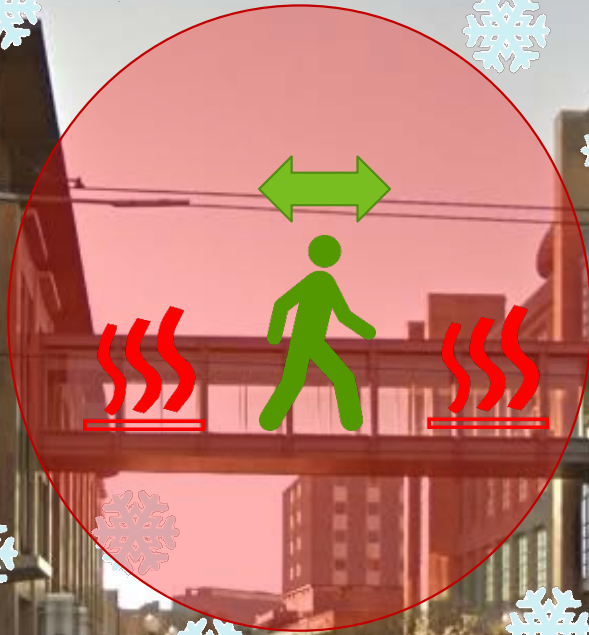
Street View - Nov 2016

Epis

Lab



St. Paul



- Increase knowledge on cgMLST

What is cgMLST

What do previous outbreaks look like using cgMLST

How does Bionumerics work

How does cgMLST compare to SNP

What are allele codes



- **In-person meetings to discuss:**

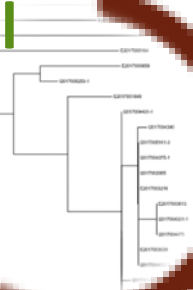
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SNP/cgMLST Comparison

Organism	N	SNP Range	Allele Range	Allele Code
S. Enteritidis	6	0-2	?	?
S. Enteritidis	5	0-1	?	?
S. Typhimurium	7	0-3	?	?
S. Heidelberg	6	0-2	?	?
E. Coli 0157	8	0-3	?	?
Campy jejuni	5	0-2	?	?

Anticipated Communication Outcomes with Epi

- Lab/epi team meeting-show epi BN 7.6
- Illustrate WGS data and clusters, discuss timing
- Determine what to communicate-allele code, MLST type, AST, cluster info, etc
- Determine best communication methods
 - Stat-PFGE inbox email/phone call
 - LIMS (new LIMS in 2019)
 - Spreadsheets
- Try for a while, meet, adjust/perfect-reduce friction

Turn Around Time

- It needs to improve
- Maintain high quality

- Lab meetings to
- discuss:

How long will analysis take

How can we do the analysis faster

How can we do the sequencing faster

How do we measure our TAT

How do we speed up getting an isolate



Isolation Timeline *Salmonella*

Stool
sample
collected

