



**Department  
of Health**

# **Transitioning to Whole Genome Sequencing for Enteric Surveillance – New York State Department of Health**

**PulseNet/OutbreakNet Regional Meeting 1/15/19**

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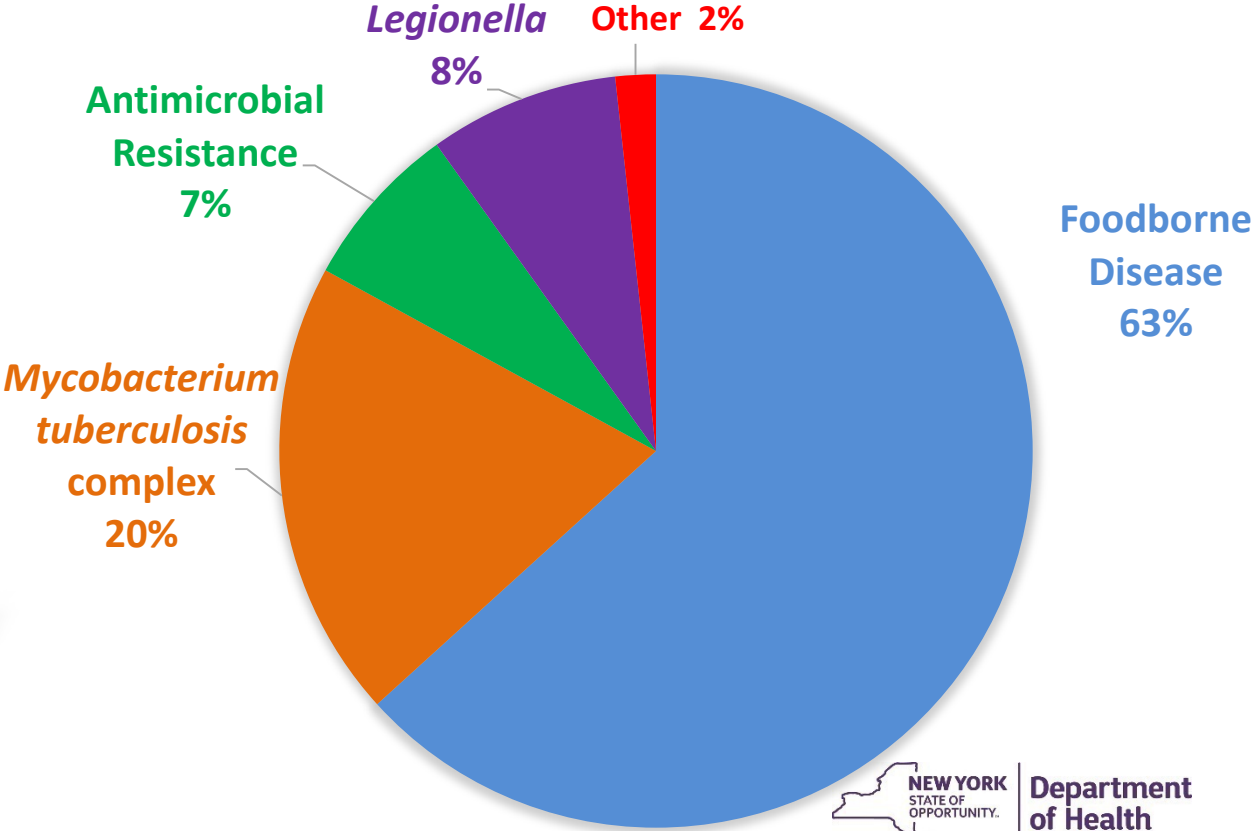
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# WC Bacteriology Laboratory WGS

>10,000. Genomes to date  
10+ bioinformatics pipelines



illumina.com



# What We Worry About

- Turn around time
- Quality – doing it right the first time
- Cost per sample – efficient use of sequencer
- Reports – are they useful to our epi's?

# Workflow For Whole Genome Sequencing

## Enterics lab:

Receives isolates

- *Listeria monocytogenes*
  - 1 Day – subculture & confirm
- *Salmonella*
  - 2 Days – subculture & confirm
- STEC
  - 4 Days to Recovery - from stool

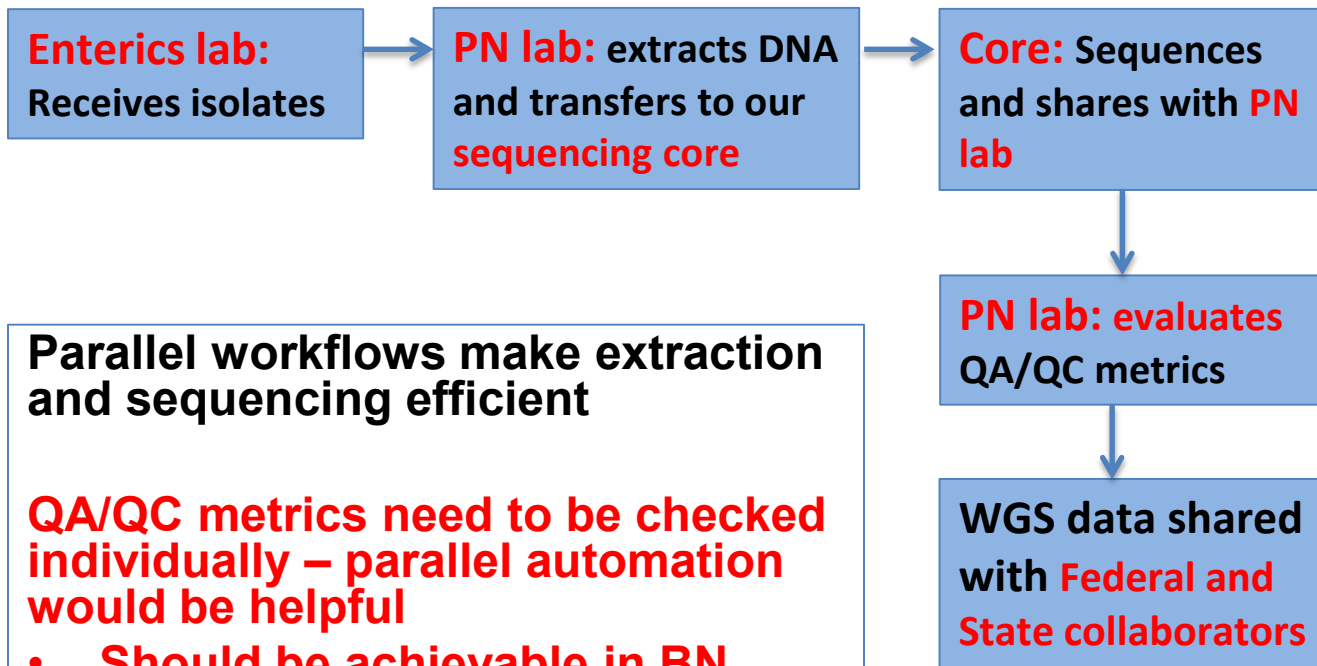
# Workflow For Whole Genome Sequencing

**Enterics lab:**  
Receives isolates



**PN lab:** extracts DNA  
and transfers to our  
**sequencing core**

# Workflow For Whole Genome Sequencing

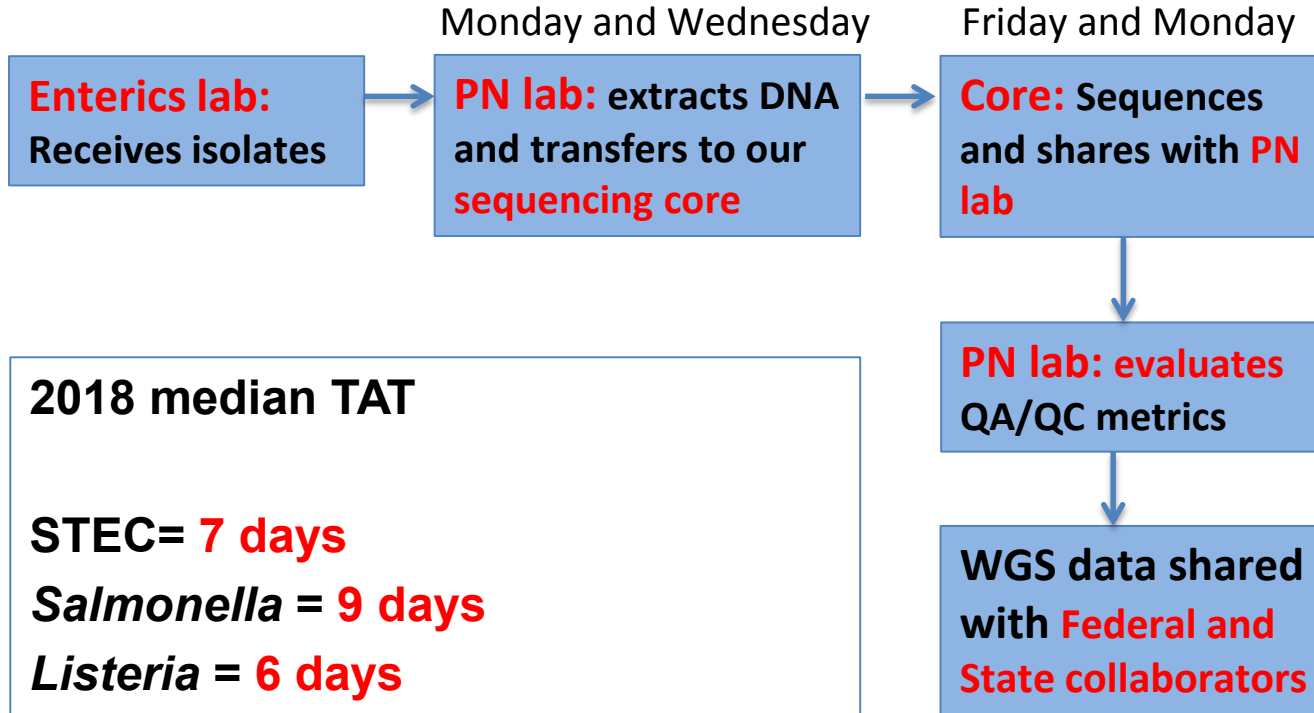


Parallel workflows make extraction and sequencing efficient

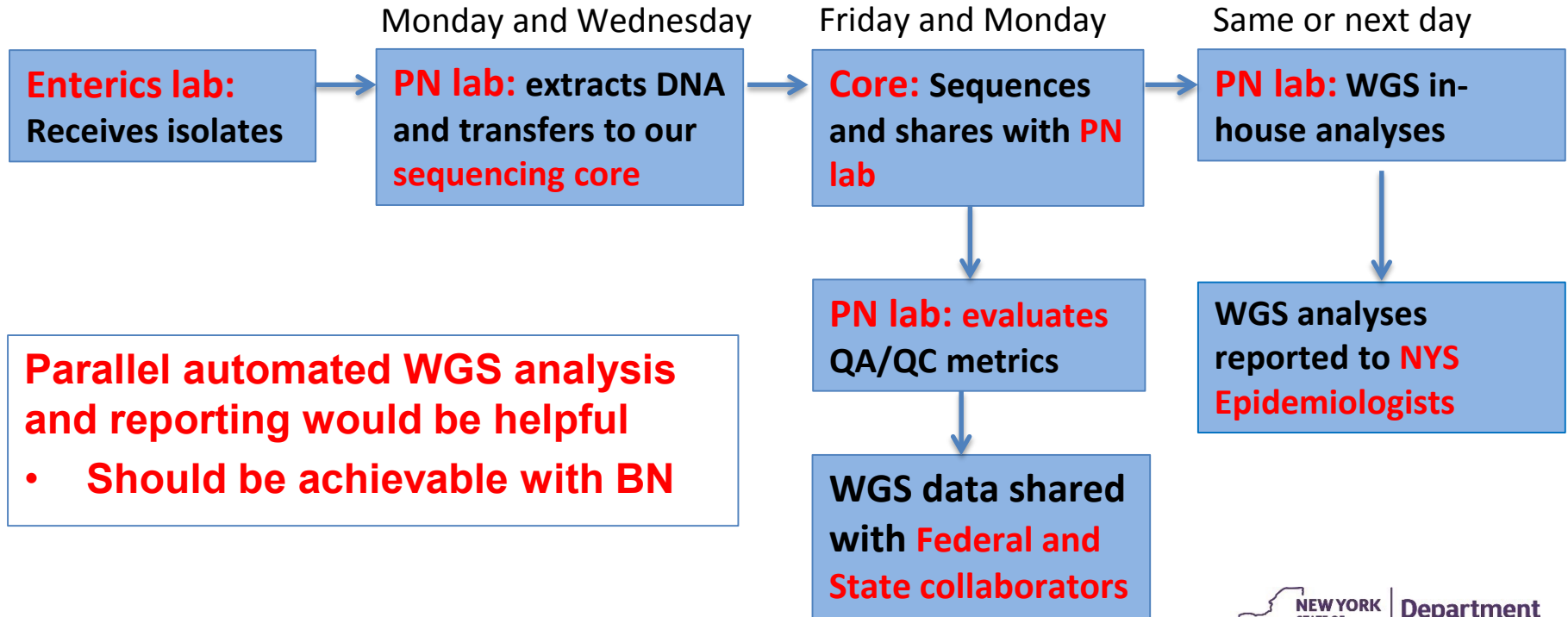
**QA/QC metrics need to be checked individually – parallel automation would be helpful**

- **Should be achievable in BN**

# Workflow For Whole Genome Sequencing






# Workflow For Whole Genome Sequencing





# Cluster Threshold Variables

- Number of isolates
  - More isolates  Fewer clusters
- Time
  - Longer Time  More Clusters
- Number of SNPs
  - More SNPs  More Clusters to a point

# WGS Cluster Criteria That Trigger a Report to NYS Epidemiologists

## ***Salmonella* Enteritidis**

- Report clusters of 3+
- In the last 60 days
- 0-5 SNPs

## **STEC**

- Report clusters of 2+
- In the last 365 days
- 0-20 SNPs

## ***Salmonella* Typhimurium**

- Report clusters of 2+
- In the last 90 days
- 0-10 SNPs

## ***Listeria***

- Report clusters of 2+
- Forever
- 0-30 wgMLST alleles

# Lab Summary

## Successes

- Workflow is becoming more efficient and should eventually meet 7day median TAT
- In house pipelines have been useful
  - Will they become obsolete?
- Establishing and reviewing cluster criteria in collaboration with NYS Epidemiologists

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## Challenges

- Increased work load related to data analysis
  - Evaluation QA/QC metrics
  - Making reports
  - Complex data management
- Reducing *Salmonella* TAT
- Reducing costs
  - NextSeq
  - Reducing repeats



# Lab-Epi Communication

- Monthly meetings (alternate sites)
- Sharing results – tried many ways
  - Emails with requests
  - Emails with embedded results
  - Emails with attachments of SNP matrixes and/or trees
  - SharePoint site
    - Specific pre-established variables

# Tracking/Linking the Cluster Data

- CDESS
- ECLRS
- Emailed documents
  - Where store?
- Microsoft SharePoint site
- Cluster database

# Example

- Accession: IDR1800022222-01
  - WGS ID: PNUSAS022222
  - State case ID: 201822222222
  - National cluster code: 1808NYGX6-1
  - WGS cluster code: LM1808-5
  - Database code: 2275
- How to streamline the data?

# 2016 – 2018 Reported Clusters

	2016	2017	2018*
Salmonella Enteritidis WGS clusters	13	19	11
Salmonella Typhimurium WGS clusters	1	24	29
STEC WGS clusters	13	21	21
Listeria WGS clusters	7	9	21
Salmonella PFGE clusters	123	138	155
STEC PFGE clusters	34	31	37
Listeria PFGE clusters	18	16	0

\*2018 data preliminary as of 1/11/2019

PFGE clusters included all clusters initiated by PFGE; WGS include all WGS clusters detected by the lab



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# Fewer or More Clusters with WGS?

## Potential increase

- Endemic PFGE patterns vs. Not endemic
  - Adds clusters that normally wouldn't investigate

## Potential decrease

- NYS STEC clusters not related by WGS: 5/29 (17%)
- NYS Salmonella PFGE clusters not related by WGS: 36/111 (32%)
  - Pending for 17 (15%)

## Unknown how will change

- Single NYS PFGE case match to out of state or food/environmental isolate
  - 12/111 Salmonella
  - 13/29 STEC



# Epi Summary

## Successes

- Improved communication with the lab
- Utilizing NCBI pathogen browser during cluster investigations
- Learning the language of WGS

## Challenges

- Tracking all the data associated with WGS
- Cluster reporting/investigation criteria
- Detecting clusters based on epi data while waiting for WGS results
- Communicating results with local health departments in a manner that makes sense



# Acknowledgements

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## BCEHFP

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