When a Cluster Becomes an Outbreak — The Multistate Perspective

Matthew Wise, MPH, PhD

Outbreak Response and Prevention Branch

Division of Foodborne, Waterborne, and Environmental Diseases

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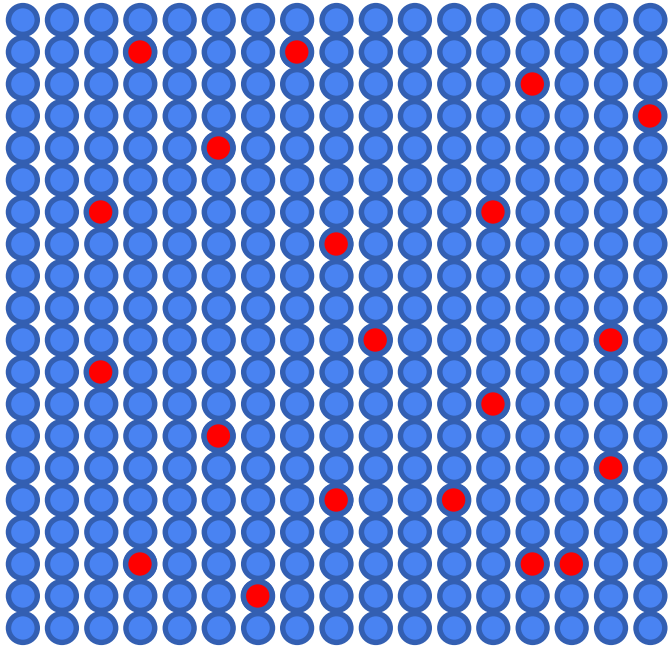
InFORM Conference: Cluster vs. Outbreak

Signal and Noise

- Epidemiologists have to evaluate all the data at their disposal to determine what to investigate
- **Clusters** represent all the “noise” that we have to sort through
  - PFGE/WGS clusters
  - Restaurant/venue sub-clusters
  - Consumer complaints
- **Outbreaks** are the “signal” that we’re trying to find
  - Individuals whose illnesses are causally linked to a common source
  - These are the illnesses that *we can do something about and learn from*

Signal and Noise

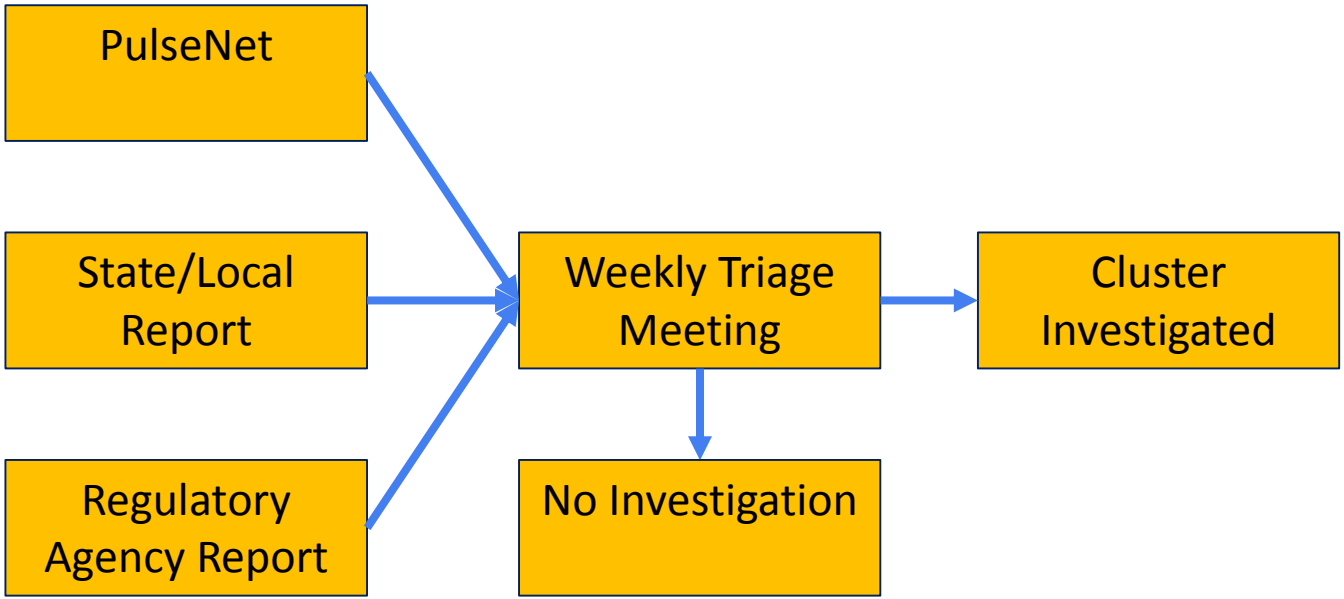


- Total of 340 clusters shown here as blue dots
  - 20, or 6%, determined to be outbreaks
- We can dial up or down the number of clusters by raising or lowering our threshold to investigate
- But we can also affect how many are determine to be outbreaks
  - What data are we using to group the illnesses together as a cluster?
  - How vigorous was the epi investigation?

ORPB Definitions for Multistate Investigations

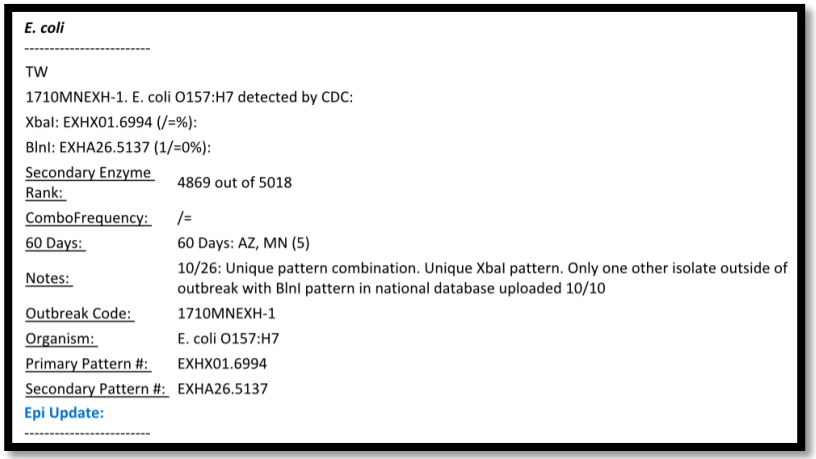
- Cluster
  - Two or more potentially related enteric illnesses
  - Reported to federal, state, or local health officials
  - That results in monitoring for additional illnesses or active epidemiologic follow-up by ORPB

Multistate Outbreaks: Pathway From Cluster to Outbreak



Deciding What to Investigate

- The decision about what to investigate depends on:
  - How recent are the illnesses?
  - Does it appear to be ongoing?
  - Is the investigation localized and being handled by a local/state agency?
  - Which pathogen is involved?



E. coli

TW

1710MNEXH-1. E. coli O157:H7 detected by CDC:

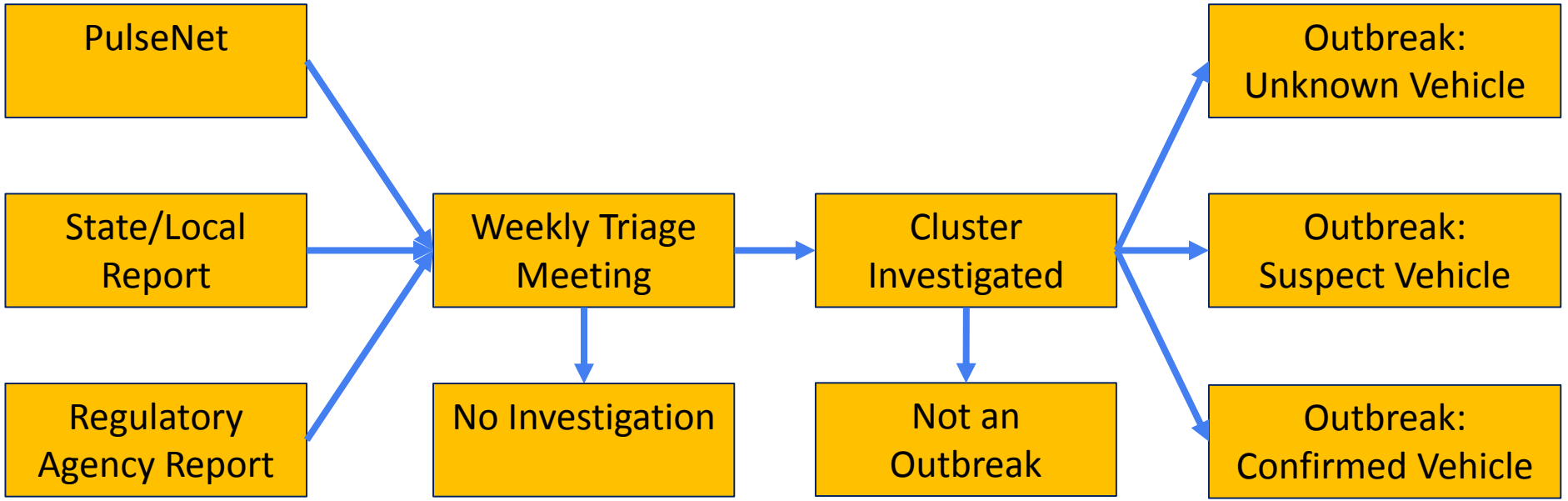
XbaI: EXHX01.6994 (/=%):

BlnI: EXHA26.5137 (1/=0%):

Secondary Enzyme Rank:	4869 out of 5018
ComboFrequency:	/=
60 Days:	60 Days: AZ, MN (5)
Notes:	10/26: Unique pattern combination. Unique XbaI pattern. Only one other isolate outside of outbreak with BlnI pattern in national database uploaded 10/10
Outbreak Code:	1710MNEXH-1
Organism:	E. coli O157:H7
Primary Pattern #:	EXHX01.6994
Secondary Pattern #:	EXHA26.5137

Epi Update:

Multistate Outbreaks: Pathway From Cluster to Outbreak



Deciding Which Clusters Are Outbreaks

- Outbreak — An enteric disease cluster with supporting data indicative of a common source
  - Temporal, geographic, demographic, dietary, travel, food history, or other information suggesting case-patients share similarities
  - The subtype of the pathogen has had a strong historical association with a specific vehicle

Categorizing Multistate Outbreaks

- Outbreak: Unknown Vehicle
  - Supporting data indicative of a common source
  - No epi, lab, or traceback data pointing to a specific vehicle

- Outbreak: Suspect Vehicle
  - 1 leg of evidence (epi, lab, or traceback) points to a specific vehicle

- Outbreak: Confirmed Vehicle
  - 2 or more legs of evidence (epi, lab, or traceback) point to a specific vehicle

Example

- Cluster – STEC O157 infections with an uncommon PFGE pattern in 11 states with no unusual demographics or common food types/preferences
- Outbreak: Unknown Vehicle – STEC O157 infections centered in the Pacific Northwest; young median age; many reports of “healthy foods”
- Outbreak: Suspect Vehicle – STEC O157 infections centered in the Pacific Northwest; romaine lettuce is reported significantly more often than expected and no other vehicles of interest
- Outbreak: Confirmed Vehicle – STEC O157 infections centered in the Pacific Northwest; romaine lettuce is reported significantly more often than expected with common brands reported; traceback shows the lettuce was all harvested from one field

Why Do We Care About These Definitions?

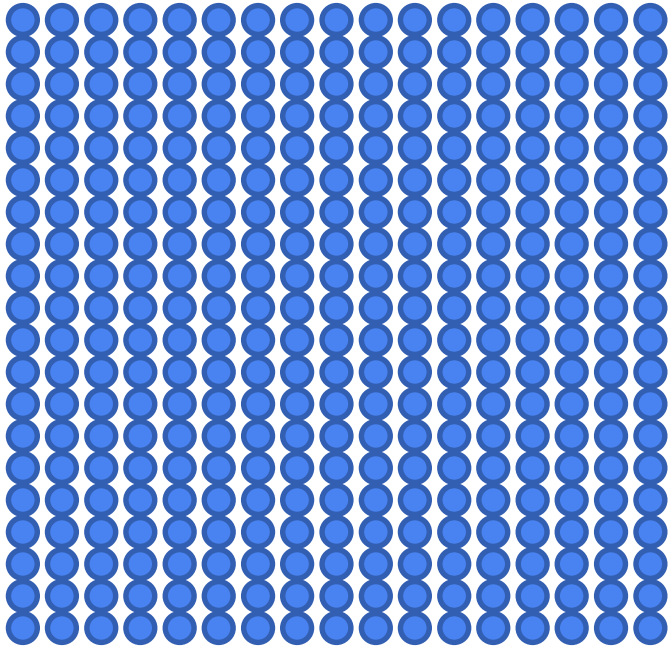
- Tracking “success”
  - Using all clusters as a denominator for calculating a solve rate is not ideal
  - Many PFGE clusters are not “solvable” because they don’t have a common source or have multiple sources

- Identifying gaps in process or prevention
  - Unknown outbreaks are outbreaks we think we could have solved but didn’t
  - Suspect outbreaks are important to report so that more difficult to solve food types are less under reported
  - Confirmed outbreaks represent data with the most confidence about the vehicle and are the best chance to work toward finding a root cause

WGS Impact on Multistate Clusters and Outbreaks

- Will exclude unrelated illnesses that had previously been included in PFGE clusters
- Will break up what had previously been large PFGE clusters into multiple smaller WGS clusters
- Will detect clusters that were never previously detected by PFGE

WGS Impact on Multistate Clusters and Outbreaks



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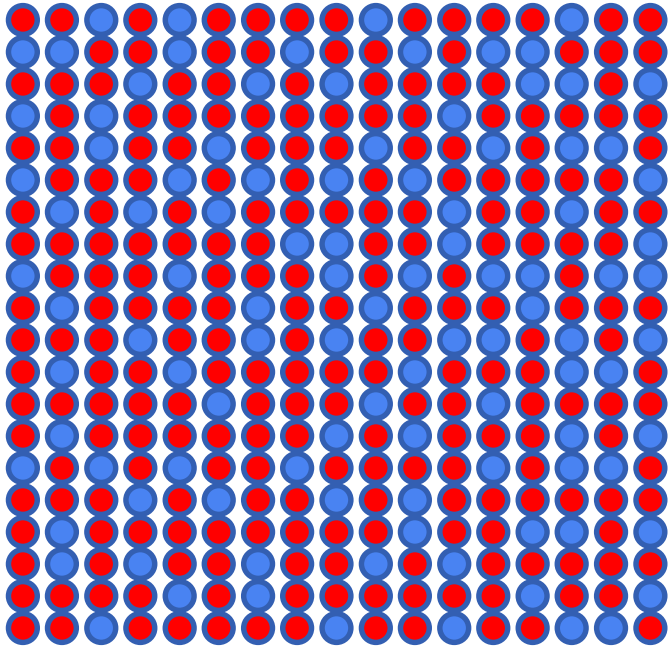
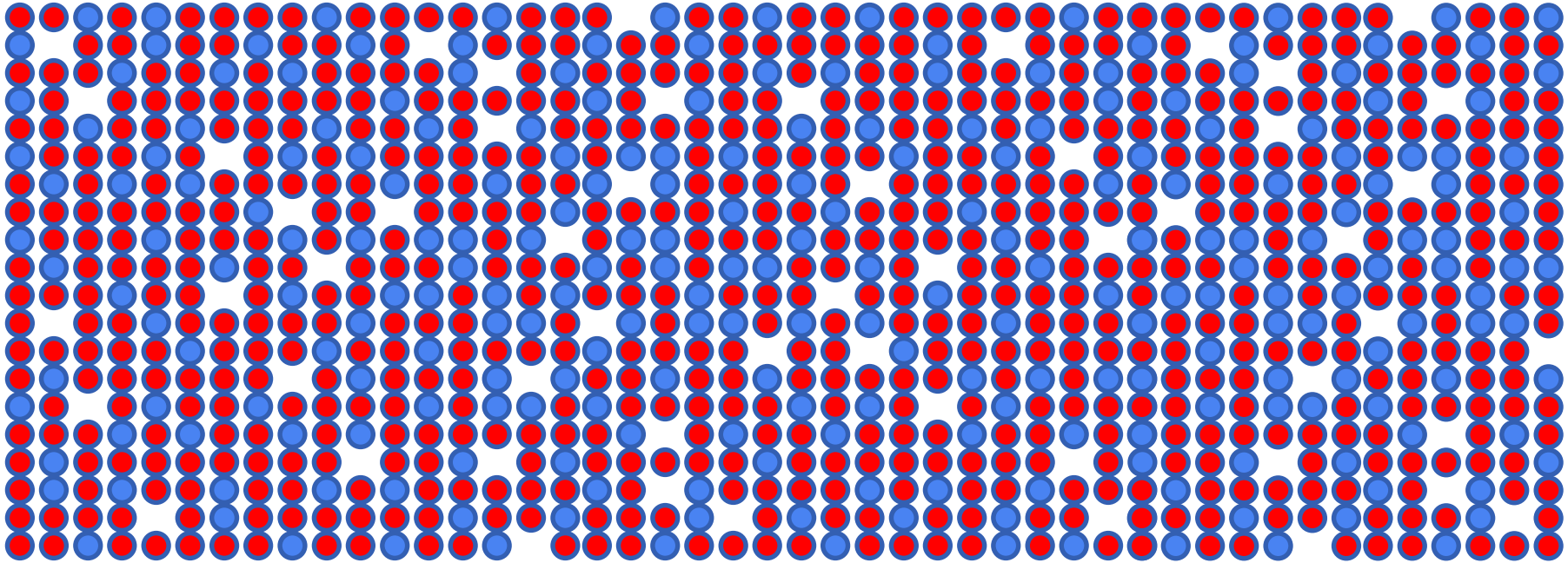


- WGS will give us much more confidence that illnesses in a cluster are all linked in some way
- But it will also help show that some PFGE clusters were just “noise
- This will likely have the effect of substantially increasing the proportion of clusters that represent true outbreaks
- Great, right!?

WGS Impact on Multistate Clusters and Outbreaks



- How will we prioritize in the face of this new volume of clusters/outbreaks?

Conclusions

- Cluster triage and investigation are tools we use to find outbreaks
- Outbreaks are groups of illnesses that we can take public health action on:
  - Stop the current outbreak
  - Understand how illnesses occurred to prevent similar outbreaks
- Having consistent definitions for these can help identify gaps in process or prevention
- WGS will likely substantially increase the number of clusters detected, but also the prior probability that the illnesses represent a true outbreak
  - Is does every WGS cluster represent an outbreak?