

Global Initiatives in the Implementation of WGS for Food Safety

Eric L. Stevens, PhD

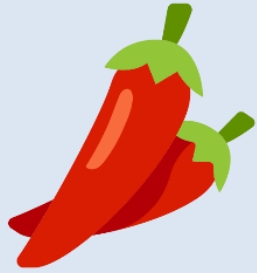
U.S. Food and Drug Administration (FDA)

Center for Food Safety and Applied Nutrition (CFSAN)

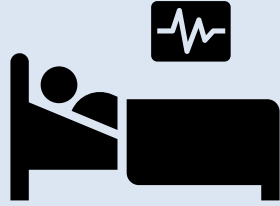
Outline

- **Case Study: US Transition to WGS**
- Expansion of US system to a global community
- Other international initiatives
- Gaps and the road ahead

Salmonella Saintpaul Outbreak Linked to Hot Peppers



- ✓ Epidemiologic
- ✓ Traceback
- ✓ Laboratory



Hospitalizations
21%
Deaths
2

1,500 cases

Onset Date Range



April 16 to August 26, 2008

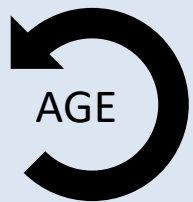


Case-Control
Studies
3



Event Sub-clusters
37

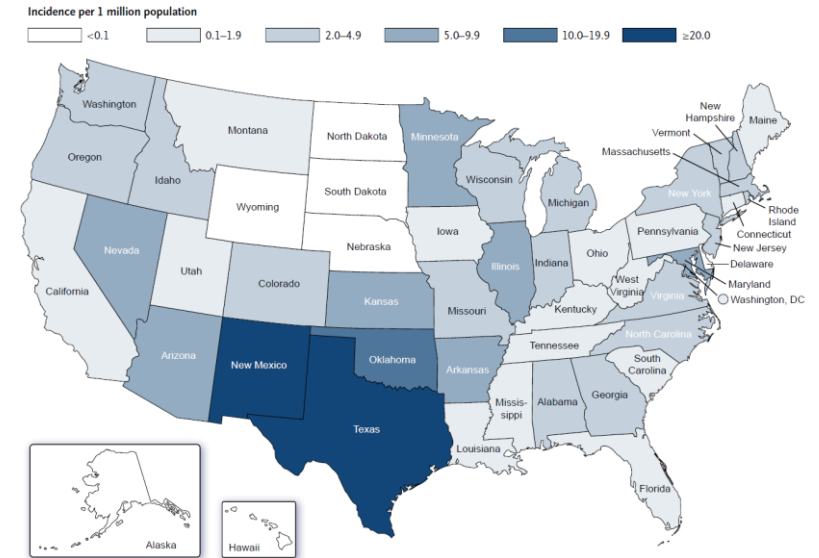
43 states



Range
<1 - 99
Median
33



PFGE Results
XbaI pattern JN6X01.0048



External Review of CDC Foodborne Illness
Detection and Investigation in Multistate Outbreaks

*April 16-17, 2009
CDC Global Communications Center
Atlanta, Georgia*

PURPOSE OF THIS REVIEW

Recent multistate outbreaks of foodborne illnesses have highlighted a range of complex issues. The purpose of this review is to provide feedback to CDC on how to improve processes and activities associated with multistate foodborne outbreaks as distinct from smaller, more temporally and/or geographically localized clusters of illness.

REVIEW PROCESS

An External Review Panel of experts in foodborne disease was convened by NCZVED. Expertise in outbreak investigation at both the state and local level, clinical medicine, food microbiology and regulatory policy, and laboratory aspects were represented on the panel.

“CDC has often lacked information that industry has on product distribution”

“...not every investigation needs a [national] case-control...”

“No communication FTEs...”

“...urgent need for a significant culture change in food safety activities at CDC.”

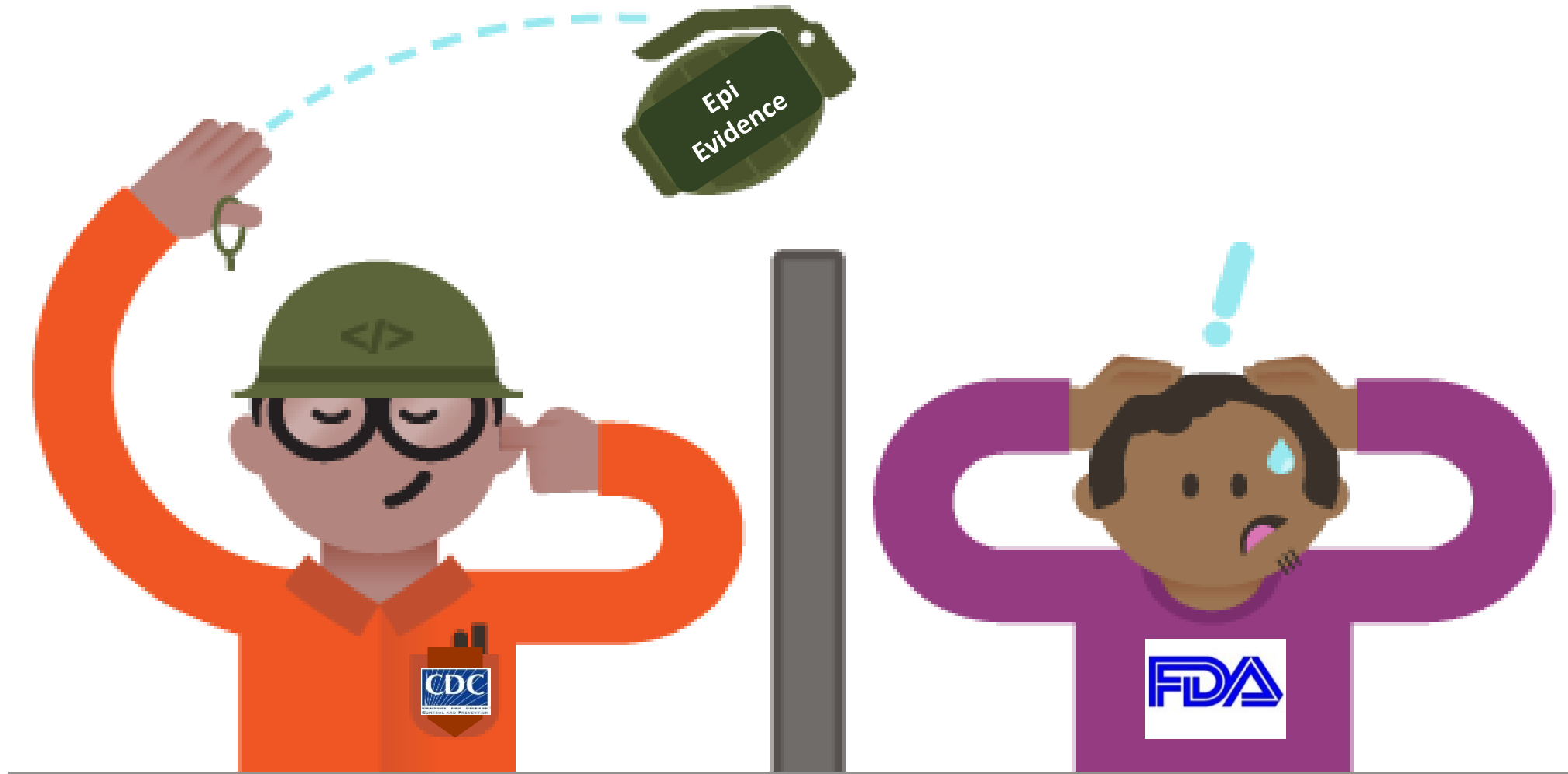
“Coordination with state and local agencies continues to be a weakness...”

“Conducting interviews in a timely manner remains the single most critical deficiency...”

“[Informatics] problems within CDC continue to substantially impact food safety activities...”

“Investigation is often far along before FDA or USDA is contacted...”

“...too much emphasis on perfecting and reinventing questionnaires...”



How we functioned for way too long

Building a Culture of Trust



- Establishment of **FDA CORE**
 - Epidemiologic staff in regulatory agency
- Increased **data transparency**
 - Open, controlled data access
- **Inclusive** engagement
 - End-to-end collaboration, detection to control
 - FDA role in epidemiologic calls
 - CDC role in industry/company calls
- Ongoing **assessments**, iterative enhancement
 - AARs, partner focus groups
 - Honest dialogue; what works, what doesn't
- **Routine** and ad hoc team meetings during investigations
- **In-person** meetings & team-building trainings

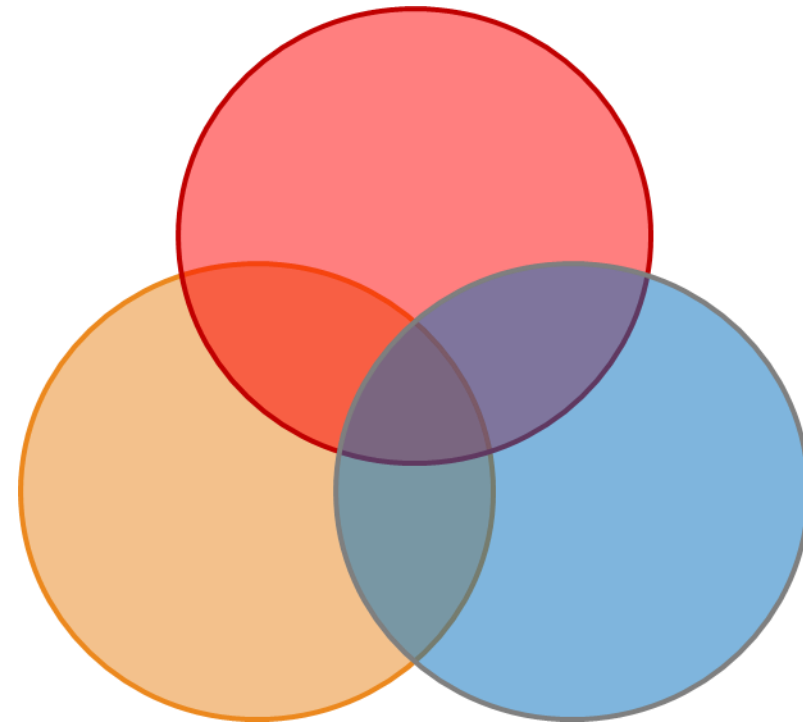


By Frits Ahlefeldt

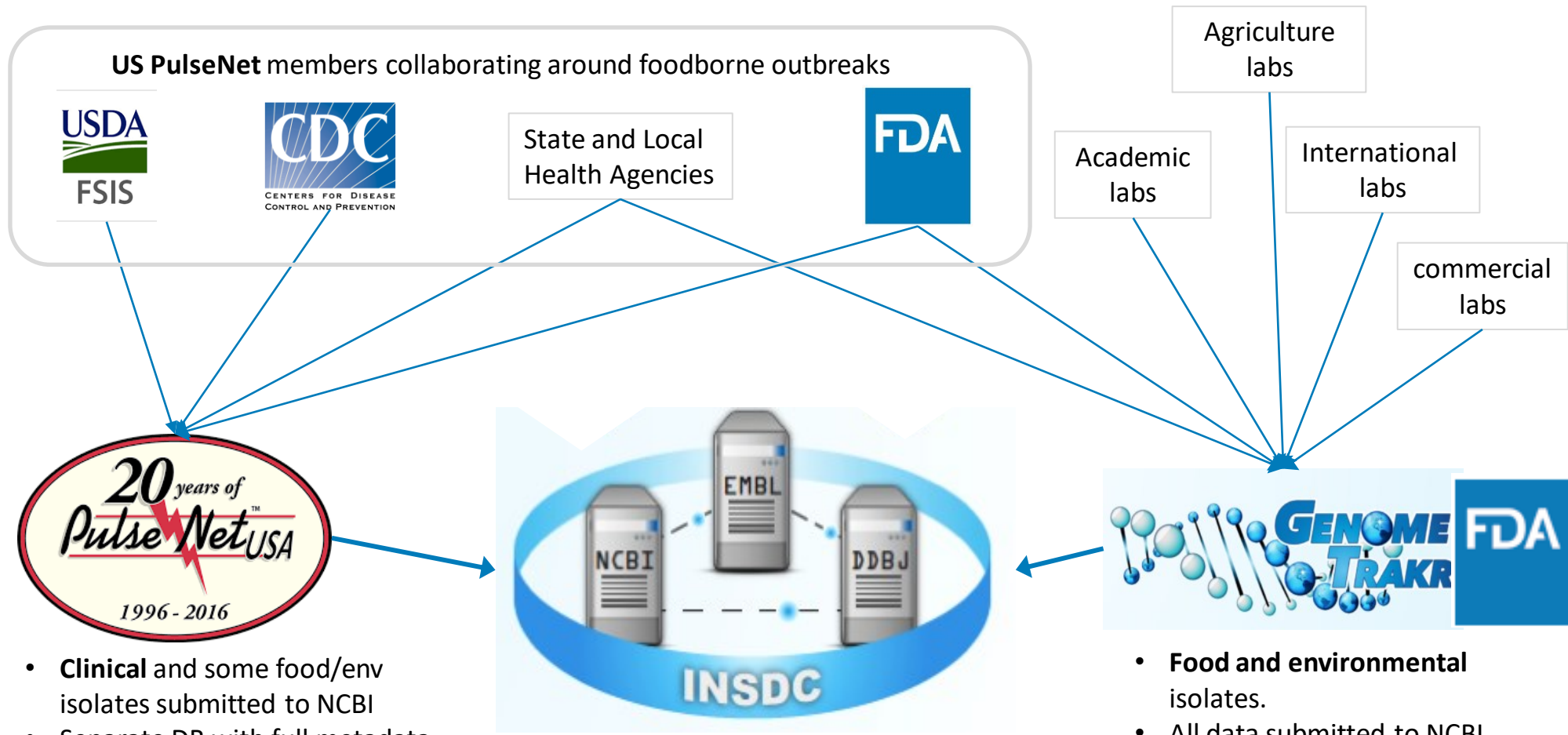
Identifying an Outbreak Vehicle: Lines of Evidence

Three types of evidence used:

- **Epidemiologic**: association between illness and food exposure
- **Traceback**: suspected food item links back to a common source of contamination
- **Microbiologic/laboratory**: pathogen found in the food, farm or facility



US Surveillance Network



- **Clinical** and some food/env isolates submitted to NCBI
- Separate DB with full metadata

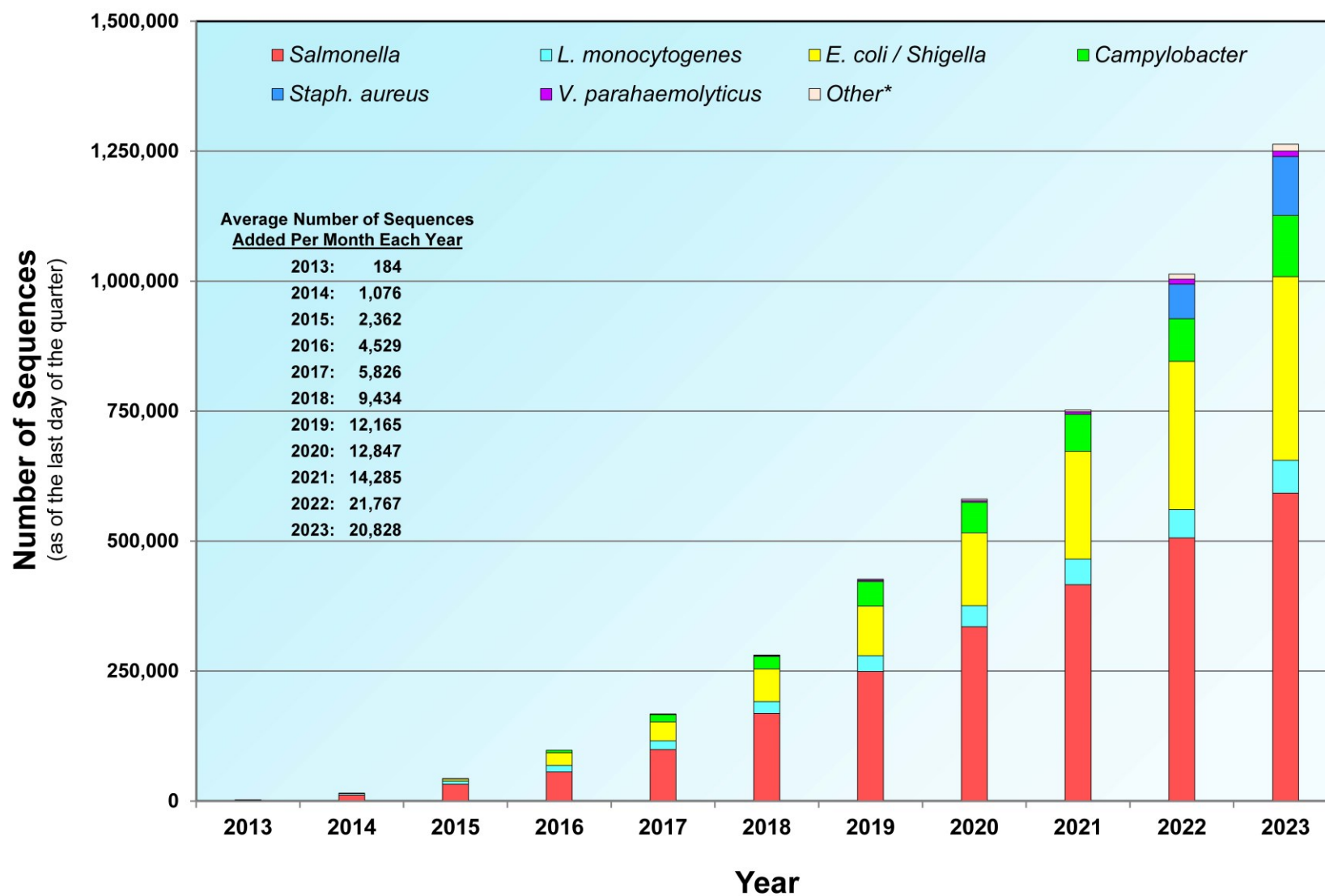
- **NCBI's Pathogen Detection**
- contains ALL WGS data generated from PulseNet and GenomeTrakr labs.
- Public Health England, Argentina, and others.
- Produces daily trees from current SNP clusters

- **Food and environmental** isolates.
- All data submitted to NCBI

Pathogen Findings

- WGS used to determine close relationships with pathogens in FDA regulated foods and manufacturing environments:
 - Environmental Samples
 - Finished Product Samples
 - Clinical isolates
- FDA Recall data shows the top 2 reasons for a product recall
 - Allergens- Misbranding
 - Pathogens in RTE Foods (*Salmonella*, *Listeria monocytogenes*)

Pathogens uploaded to NCBI PD



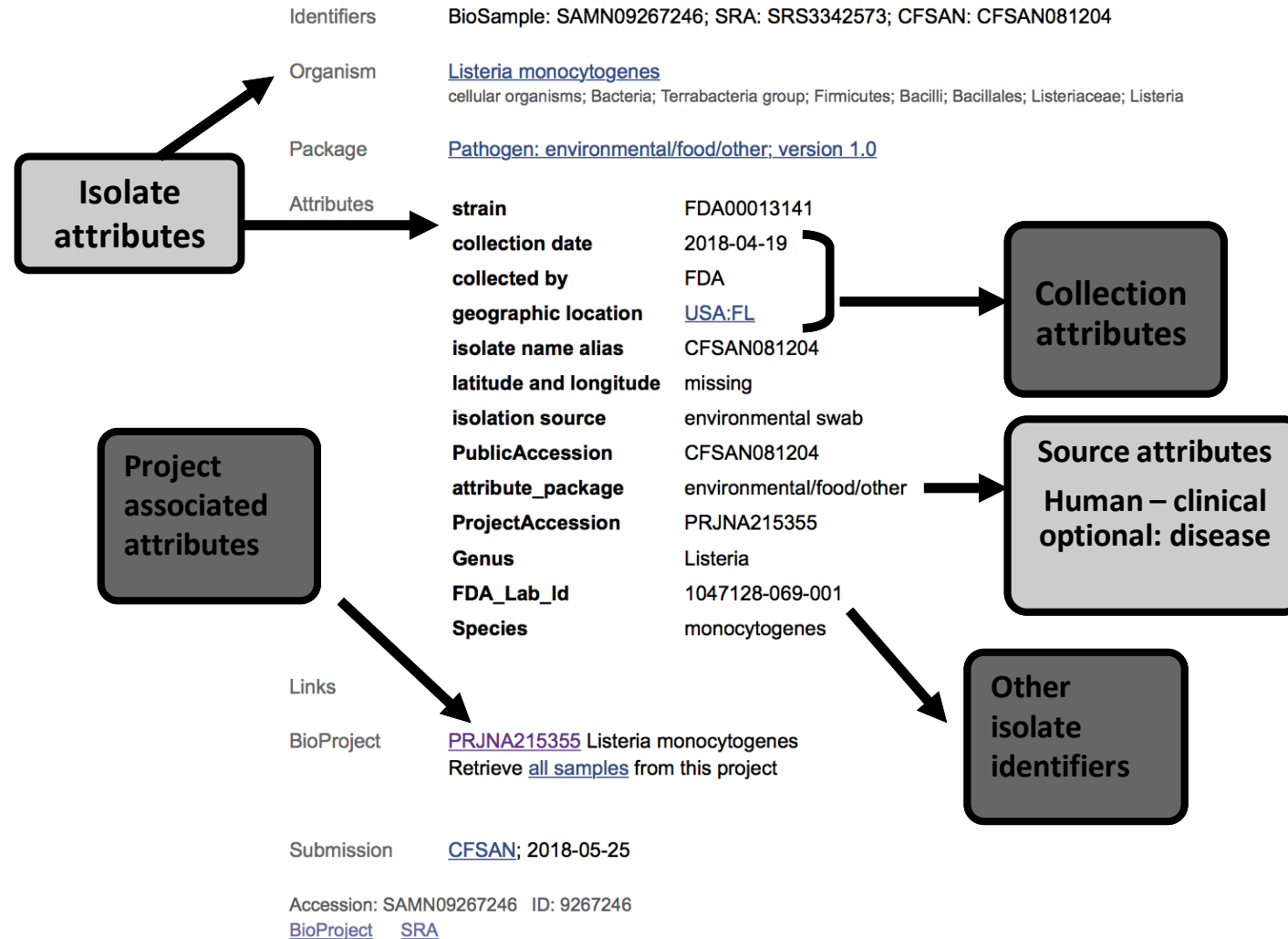
First sequences uploaded in February 2013

* Other pathogens: *Cronobacter*, *V. vulnificus*, *C. botulinum*, *C. perfringens*, and *Bacillus cereus* group

NCBI: Not Just Genomes!



Pathogen: environmental/food/other sample from *Listeria monocytogenes*



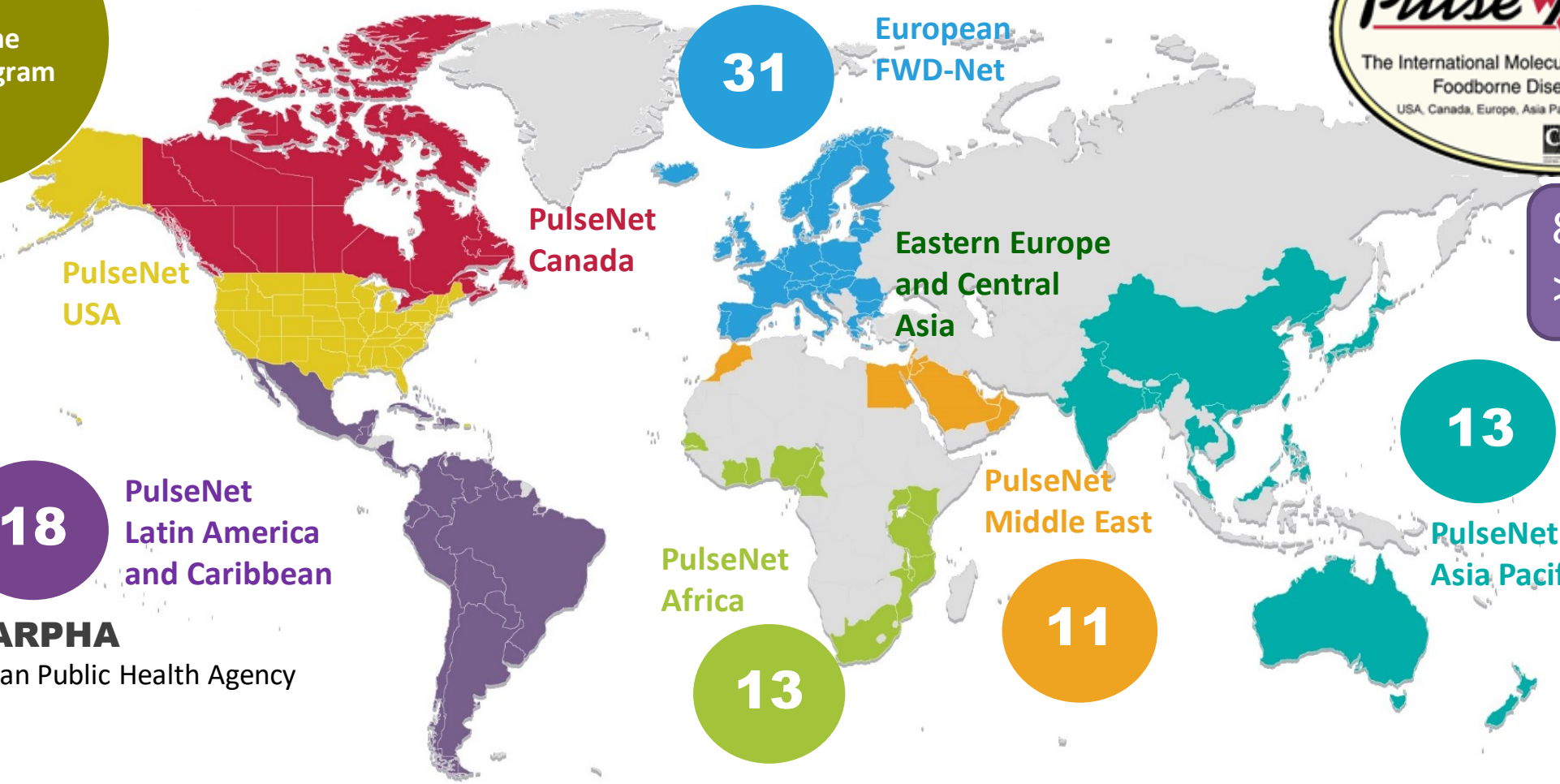
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Global Foodborne Disease Program



8 Regions
>80 Countries



18 PulseNet Latin America and Caribbean
+CARPHA
Caribbean Public Health Agency



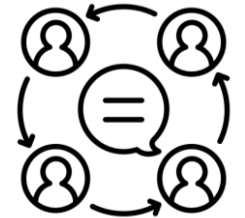
PulseNet Lab Capacity



AR Surveillance

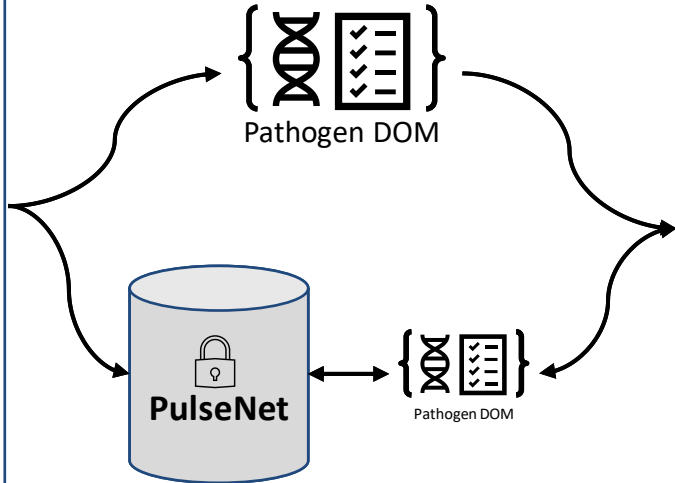
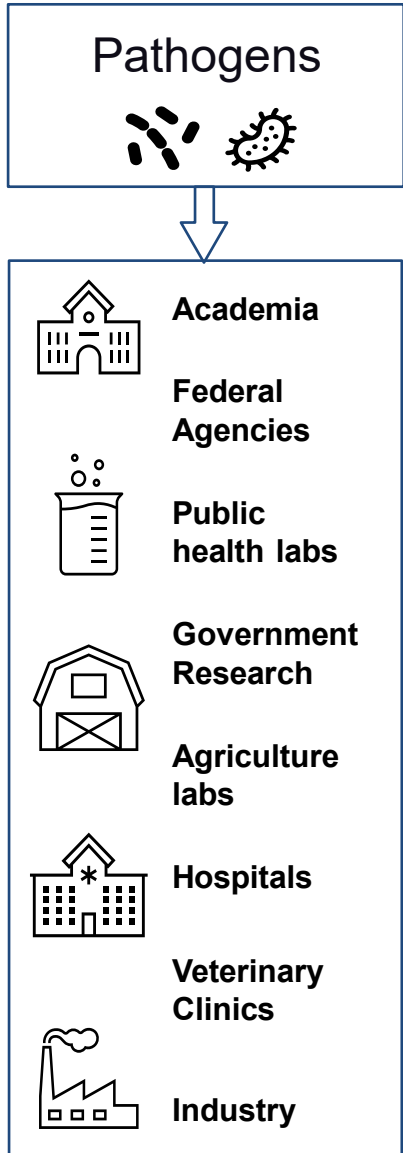


Quality Assurance



Lab/Epi Communication: Interpreting Data for Action

Global enteric pathogen surveillance



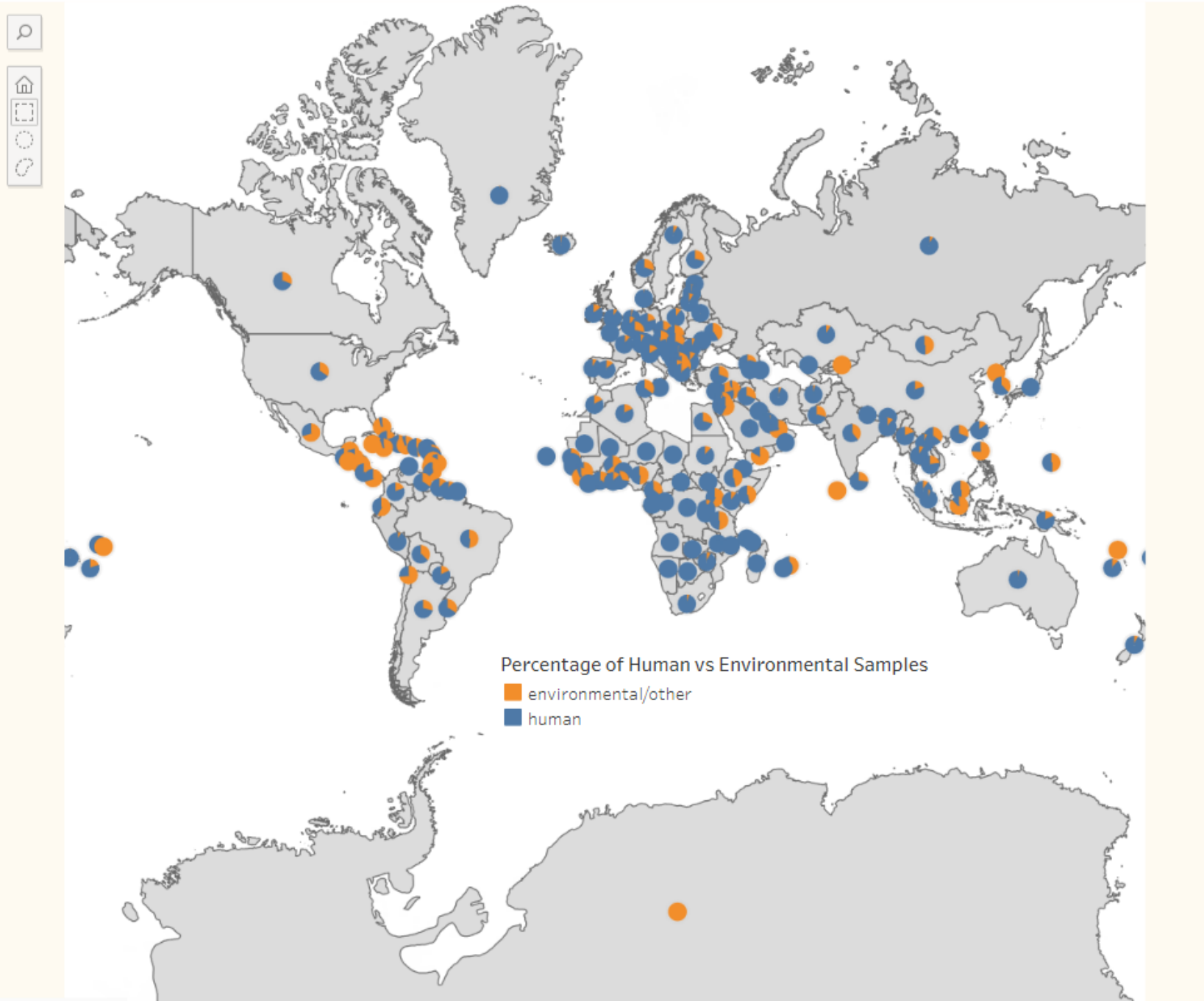
NCBI Pathogen Detection

Phylogenetic tree showing relationships between various *Escherichia coli* and *Salmonella enterica* strains. The tree is rooted and shows clusters of related sequences.

#	Scientific name	RefSample	Contig	Start	Stop	Strand	Element name	Type	Scope	Subtype	Class
1	<i>Escherichia coli</i>	SAHE41676202	UW9010000072.1	3	1166	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
2	<i>Escherichia coli</i>	SAHE41676203	UW9010000051.1	3745	3994	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
3	<i>Escherichia coli</i>	SAHE41676300	UW9010000052.1	3447	5056	+	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
4	<i>Escherichia coli</i>	SAHE41676266	UW901000009.1	16524	17017	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
5	<i>Escherichia coli</i>	SAHE41676283	UW901000004.1	2	1162	+	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
6	<i>Escherichia coli</i>	SAHE41676315	DADSP10000020.1	10314	11539	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
7	<i>Escherichia coli</i>	SAHE41676315	DADSP10000021.1	1074	3591	+	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
8	<i>Salmonella enterica</i>	SAHE41676215	AAX3201000003.1	2695	3995	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
9	<i>Salmonella enterica</i>	SAHE41676215	AAX3201000004.1	1661	7620	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
10	<i>Escherichia coli</i>	SAHE41676393	AAT9100000041.1	33	1463	+	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
11	<i>Escherichia coli</i>	SAHE41676239	AZ_49427963.1	104931	1042156	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
12	<i>Escherichia coli</i>	SAHE41676216	DADSP10000009.1	47041	48669	+	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN
13	<i>Escherichia coli</i>	SAHE41676316	DADSP10000023.1	47261	48931	-	MCR-1 family phosphotransferase- <i>lptA</i> A transferase	AMR	core	AMR	COLISTIN

FDA public dashboards





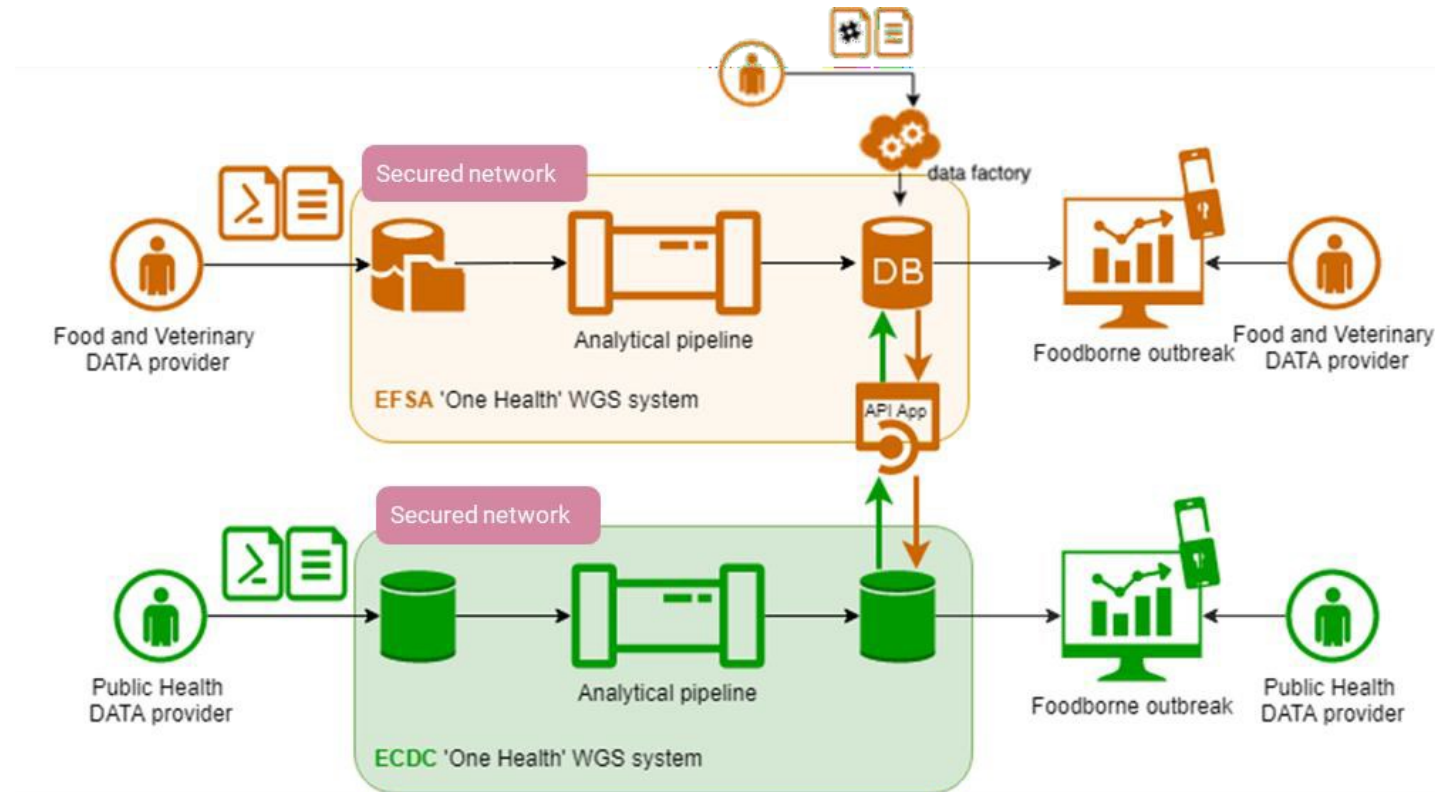
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EU ONE HEALTH WGS DATA SHARING MODEL

COMBINATION OF APPROACHES

- **Controlled-Centralized Data Sharing at sector level:** EFSA and ECDC collect data centrally based on their remit
- **Cross-Sectoral Collaboration:** interoperability and comparability of the EFSA and ECDC platforms allow the data exchange for allowing cluster detection and outbreak investigation





Why PHA4GE

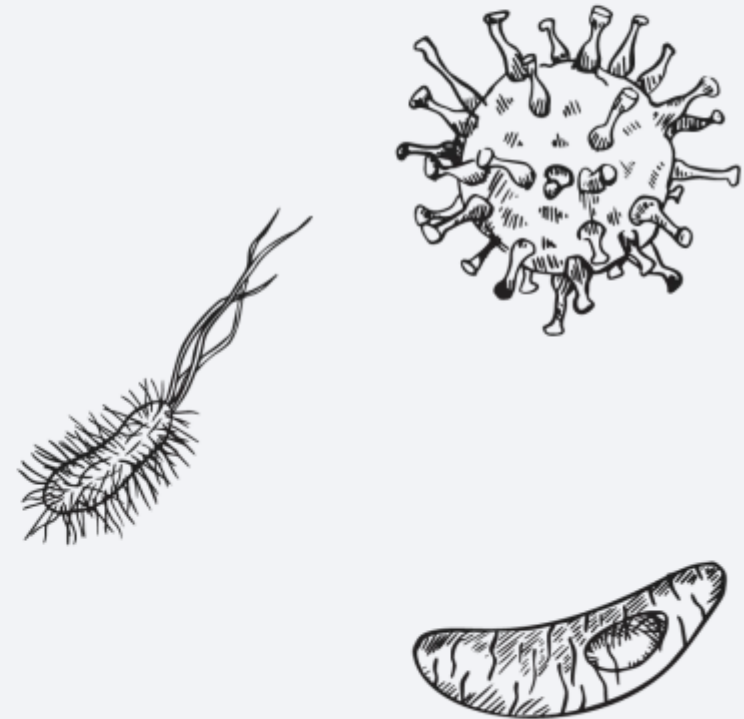
Establish Global Consensus Data Standards >

To Document And Share Best Practices >

To Improve The Availability Of Critical
Bioinformatic Tools And Resources >

To Advocate For Greater Openness,
Interoperability, Accessibility And Reproducibility
In Public Health Bioinformatics >

Join PHA4GE →





WHO's new guidance document:

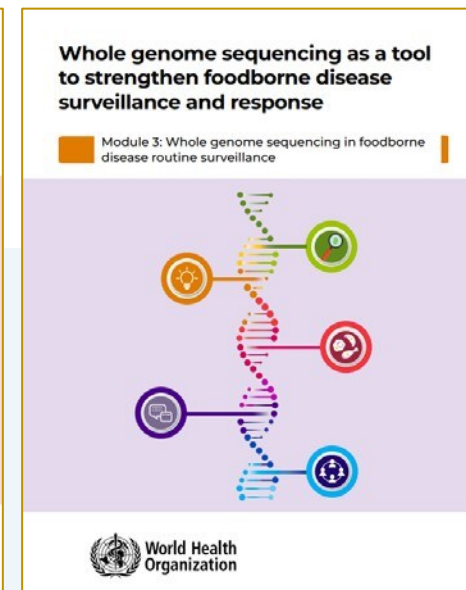
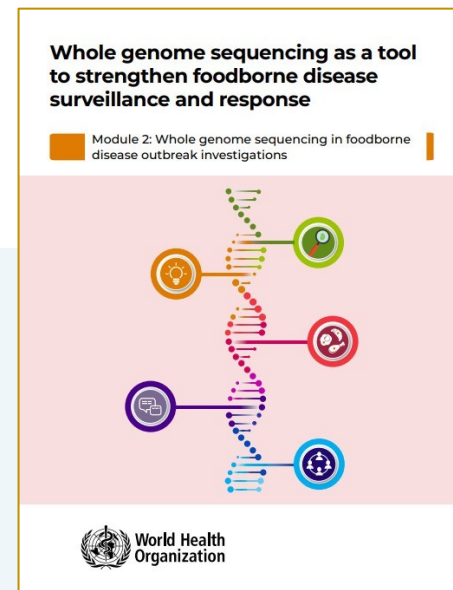
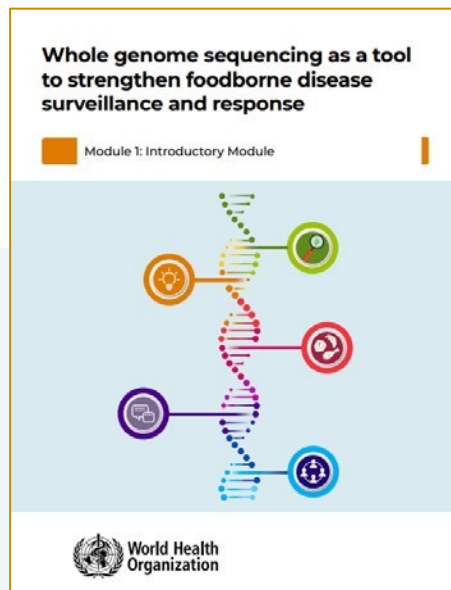
Whole genome sequencing as a tool to strengthen foodborne disease surveillance and response



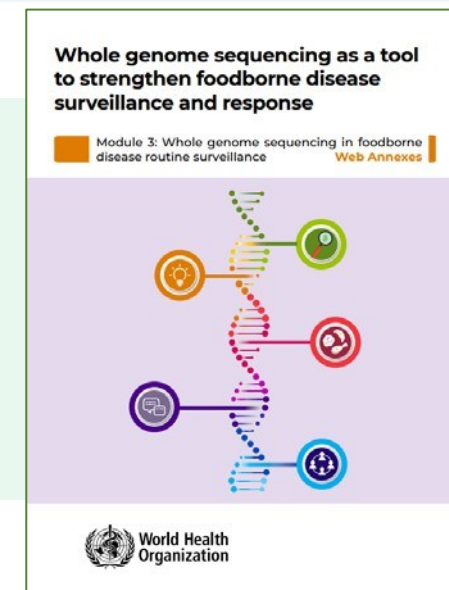
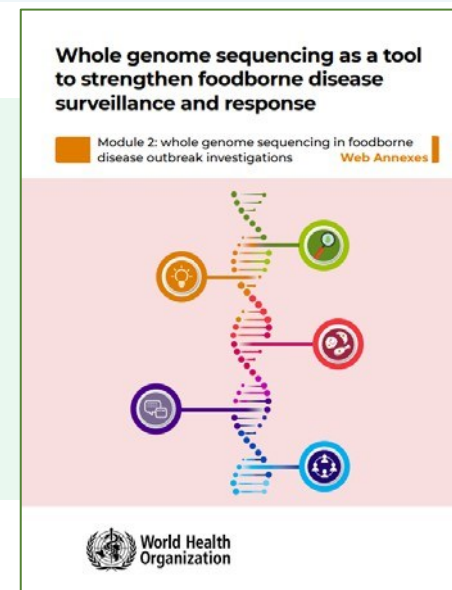
- Motivation
- Development



Modules 1, 2,
and 3



Web Annexes 1
and 2



New WHO Alliance for Food Safety to Increase Global Capacity for Foodborne Illness Surveillance

By Food Safety Magazine Editorial Team

The [World Health Organization](#) (WHO), in collaboration with the European Centers for Disease Control and Prevention Division of Foodborne Waterborne and Environmental Disease (CDC DFWED), is launching the WHO Alliance for Food Safety to meet foodborne disease surveillance targets set in the [WHO Global Strategy for Food Safety 2022–2030](#). The WHO Alliance for Food Safety will convene for its [inception meeting](#) from May 6–8, 2024 in Geneva, Switzerland and virtually.

The WHO [Global Strategy for Food Safety 2022–2030](#), which was adopted in May 2022, sets out five strategic priorities for the advancement of food safety and target goals to guide action and track progress toward reducing foodborne illnesses worldwide. One such target goal is to increase the global capacity for surveillance of foodborne diseases and contamination from a score of 1.5 in 2022 to 3.5 by 2030 (based on the International Health Regulations Joint External Evaluation Tool). To align efforts across countries and support capacity-building efforts, WHO and CDC hope to reactivate WHO's Global Foodborne Infections Network (GFN) and tap into its network of Collaborating Centers to serve as the basis of the WHO Alliance for Food Safety. The Alliance will also include other institutions with

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Upcoming Opportunities

- SIWW June 2024 Singapore
- GMI14 in Barcelona (September 4-6, 2024)
- GMI15 in Melbourne, Australia (2025)
- ANY INTERNATIONAL MEETING AT THE ONE HEALTH INTERFACE

Thank you!



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