



United States Department of Agriculture

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Food Safety and Inspection Service

Protecting Public Health and Preventing Foodborne Illness





Molecular Comparison of New Strains of Shiga-Toxigenic *E. coli* Isolated from FSIS Beef Product Samples with Human Strains During FY 2015 – FY 2017

Wu San Chen, MD, MSPH

Karen M. Becker, DVM, MPH, DACVPM

William A. Lanier, CDR (USPHS), DVM, MPH, DACVPM

USDA, Food Safety and Inspection Service

Office of Public Health Science

Applied Epidemiology Staff

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Purpose of Study

Cattle are the principal reservoir for Shiga toxin-producing *E. coli* (STEC). Identifying indistinguishable strains from beef product testing and clinical specimens could be an indication for human STEC infections plausibly acquired from beef product consumption or animal contact.

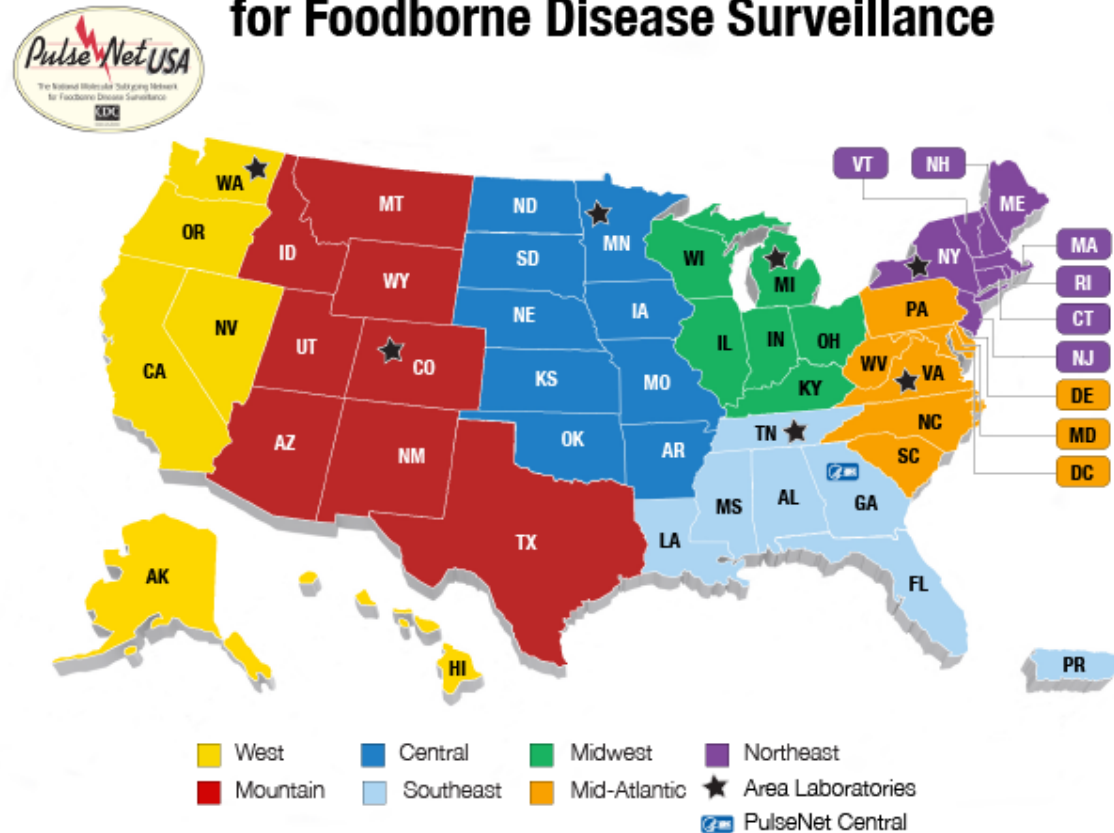
The study uses PFGE patterns, named by CDC PulseNet, as a tool to compare strains of STEC isolates from FSIS beef samples and human specimens.

The study focuses on **new** PFGE patterns, patterns that have not been seen previously in the PulseNet database.

- ❑ National laboratory network that connects foodborne illness cases to detect outbreaks.
- ❑ Made up of 83 federal, regional, state, and local laboratories.
- ❑ Uses DNA subtyping (PFGE & WGS) to detect outbreaks.

PulseNet

The National Molecular Subtyping Network for Foodborne Disease Surveillance



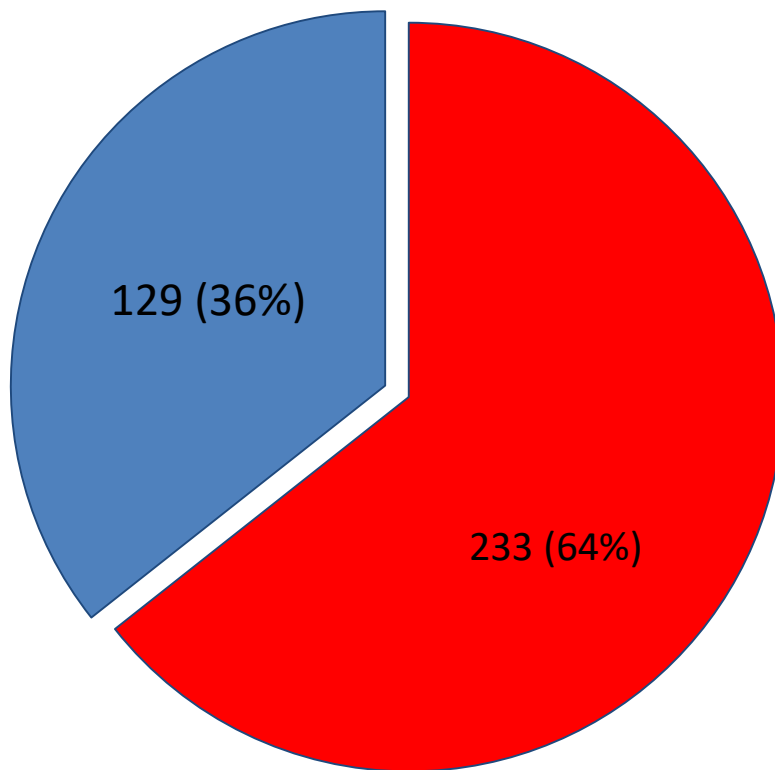
FSIS STEC Testing (FY2015 – FY2017)

- ❑ 397 FSIS STEC isolates from FSIS regulatory and beef-veal carcass baseline study samples were uploaded to PulseNet, including 94 (24%) *E. coli* O157:H7 isolates and 303 (76%) non-O157 STEC isolates.

- ❑ 362 PFGE distinct patterns were identified from the 397 STEC isolates.
 - 81 (22%) patterns from *E. coli* O157:H7 isolates.
 - 281 (78%) patterns from non-O157 STEC isolates.

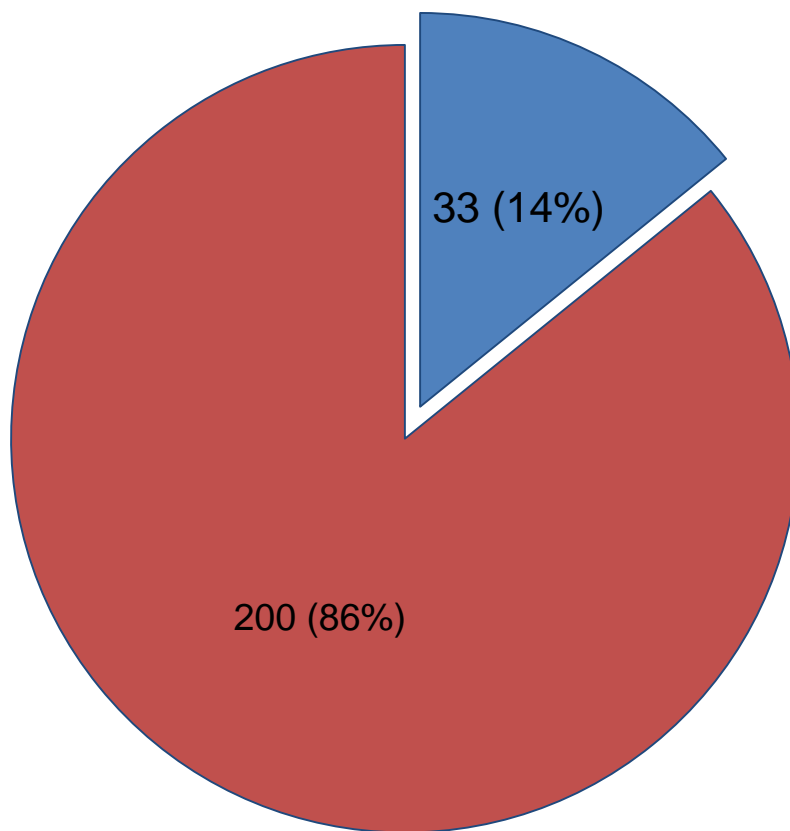


FSIS STEC PFGE Patterns in PulseNet (N=362)



■ New Pattern ■ Old Pattern

STEC Serogroup Distribution Among the New FSIS PFGE Patterns (N=233)



■ *E.coli* O157:H7 ■ NonO157 STEC

Clinical Isolates Indistinguishable from New FSIS PFGE Patterns

- The 233 new PFGE patterns were monitored to search for human clinical STEC isolates matching the patterns in this study time period.

- Methods of monitoring the 233 new PFGE patterns:
 - CDC PulseNet databases.
 - FSIS T-Cube database.



Results of New Pattern Monitoring During FY 2015 – FY 2017

- ❑ Of the 33 new *E. coli* O157:H7 PFGE patterns from FSIS isolates, there were no indistinguishable clinical isolates with these patterns.

- ❑ Of the 200 new non-O157 STEC PFGE patterns from FSIS isolates, 12 clinical isolates (10 *E. coli* O103 and 2 *E. coli* O111), were indistinguishable with 6 (3%) of those patterns:
 - 5 STEC *E. coli* O103 patterns
 - 3 recovered from beef carcass swab samples
 - 2 recovered from beef trim samples
 - 1 STEC *E. coli* O111 pattern
 - 1 recovered from a beef carcass swab sample

- ❑ Isolation dates between FSIS isolates and clinical isolates ranged from 4 to 32 months with a median of 13.5 months.



Highlights

- ❑ Most of the FSIS STEC PFGE patterns were new to PulseNet.
- ❑ During FY2015 – FY2017, most new FSIS STEC patterns differ from clinical STEC isolates.
- ❑ 12 non-O157 STEC clinical isolates matched 6 FSIS STEC new PFGE patterns.
- ❑ The median interval of the isolation dates between FSIS isolates and PFGE-matched clinical isolates was 13.5 months.
- ❑ None of the PFGE-matched clinical isolates have been included in recognized outbreaks (i.e. “sporadic cases”); FSIS has not requested exposure history for those cases.

Conclusion

- ❑ The results indicate a highly diverse STEC PFGE pattern distribution between FSIS testing and human infections. The diversity may indicate the difference in pathogenicity among the STEC strains.
- ❑ The FSIS STEC new-pattern monitoring program could be a useful tool to early detect a possible zoonotic origin for some emerging strains of human STEC infections.
- ❑ FSIS is exploring establishment of a protocol for requesting exposure information from clinical STEC cases that match new PFGE patterns from FSIS testing to search for potential associations between FSIS-regulated products and human STEC infections..



Any questions?