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Inter-agency Public Health Collaboration: Western States *Escherichia coli* O157:H7 Investigation Associated with Ground Beef

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ABSTRACT

Between January 1 and December 31, 2007, 10 of 21 voluntary recalls of ground beef products were associated with *Escherichia coli* O157:H7 infections. The 2007 Western States *E. coli* O157:H7 investigation illustrates the importance of inter-agency collaboration and availability of accurate product information to enhance outbreak response. Foodborne disease investigations have become increasingly complex. Coordination and collaboration between public health partners throughout investigations are essential to respond to reports of illness and ultimately reduce the burden of illnesses caused by foodborne pathogens.

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INTRODUCTION

Healthy People 2010 is a comprehensive framework outlining disease prevention and health promotion objectives for the United States *(7)*. The goal of the food safety focus area is to reduce foodborne illnesses, with the specific objectives of reducing infections caused by *Campylobacter*, *E. coli* O157:H7, *Listeria monocytogenes*, and *Salmonella* and reducing outbreaks caused by *E. coli* O157:H7 and *Salmonella* Enteritidis *(7)*. According to the Centers for Disease Control and Prevention (CDC), foodborne infections contribute to approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the U.S. each year *(9)*. In 2007, there were 1,097 outbreaks reported electronically to CDC's Electronic Foodborne Outbreak Reporting System; 257 (23%) of those were confirmed to be attributed to a bacterial etiology and 199 (18%) to a viral etiology *(1)*. There were 36 *E. coli* O157:H7 outbreaks reported to CDC in 2007 *(1)*. The Food Safety and Inspection Service (FSIS) coordinated 21 voluntary recalls of ground beef products in 2007, 10 of which were associated with *E. coli* O157:H7 infections. This paper describes the inter-agency collaboration during one of the *E. coli* O157:H7 investigations.

Foodborne illness investigations that span multiple agencies and jurisdictions have become more common as the U.S. food supply chain has become increasingly complex because of wider distribution of products produced domestically and internationally. Further, advances in epidemiologic and laboratory surveillance have enabled the identification of foodborne outbreaks. Consequently, successful investigations require efficient communication and coordination among local, state, and federal public health agencies and regulated industries. The ability to control and mitigate a foodborne outbreak to prevent further illnesses depends upon rapidly identifying contaminated food products and taking control measures to limit consumers' exposure to contaminated products, including removal of these products from commerce whenever possible.

FSIS is the public health regulatory agency within the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and processed egg products is safe, wholesome, and correctly labeled and packaged. To ensure compliance with U.S. food safety standards, FSIS inspects and monitors all meat, poultry, and processed egg products sold in interstate and foreign commerce.

The Foodborne Disease Investigations Branch (FDIB) is the point of contact linking public health partners (local and state health departments, local and state agricultural departments, and other federal agencies) to FSIS experts on a variety of food safety issues. FDIB is staffed by public health professionals with backgrounds in epidemiology, environmental health, veterinary medicine, clinical medicine, and other related disciplines. During foodborne illness investigations, FDIB assesses epidemiologic information, assists with traceback of implicated foods to producing establishments, facilitates sampling to identify pathogens that may be causing human illness, and provides information to FSIS senior management.

WESTERN STATES *E. COLI* O157:H7 INVESTIGATION

On May 25, 2007, FDIB was notified by the FSIS Liaison to CDC of a cluster of eight case-patients with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern combination, in Arizona, California, Colorado, Utah, and Wyoming. California case-patients purchased ground beef products from Grocery Store A. Colorado, Utah, and Wyoming case-patients purchased ground beef products from Grocery Chain B in their respective states.

On May 30 and May 31, 2007, *E. coli* O157:H7 was confirmed in leftover ground beef products collected from California and Colorado case-patients, respectively. Personnel from FSIS and the California Dept. of Public Health, Food and Drug Branch (FDB) conducted a joint traceback investigation on May 31, 2007 at the California retail stores to identify production dates corresponding to the positive leftover products. Limited packaging material from the California case-patient initially identified Establishment X as the supplier of ground beef products purchased at Grocery Store A. No labeling information was available for the Colorado case-patient. A review of grinding logs and invoices corresponding to case-patients' purchase dates identified Establishment X as the supplier of ground beef products to both California and Colorado retail locations. FSIS Office of Program Evaluation, Enforcement and Review investigators from California and Colorado and the FDB initiated a traceback investigation to determine if products from common production dates were distributed and available at retail locations. After a thorough record review, FSIS determined that ground beef products produced on April 20, 2007 by Establishment X were common to the retail locations in California and Colorado. As a result, the establishment voluntarily recalled 75,000 pounds of ground beef products on June 3, 2007. Further investigation by the FDB identified April 13, 2007 as an additional production date of interest. Through the review of invoices and distribution information at the grocery stores, FSIS confirmed the involvement of the additional production date. As a result, on June 6, 2007, the establishment expanded the initial recall to include 375,000 pounds of ground beef products produced on April 13, 2007. The Wyoming and Utah case-patients were unable to provide further details on the dates of purchase; therefore, traceback investigations at those retail stores could not be conducted.

On June 1, 2007, the Arizona Dept. of Health Services (ADHS) reported six case-patients with *E. coli* O157:H7 infections, two with a PFGE pattern combination indistinguishable from the outbreak pattern. Case-patients reported purchasing ground beef products at Grocery Chain C. Leftover product from two case-patients was presumptive positive for *E. coli* O157:H7 on June 5, 2007. A traceback investigation initiated by FSIS also identified Establishment X as the ground beef supplier. Based on the findings from the FSIS investigation and the ADHS epidemiologic investigation, the establishment announced a second expansion of the recall on June 9, 2007 for 5.7 million pounds of ground beef products produced between April 6 and April 20.

After the second recall expansion, ADHS continued to find case-patients with the outbreak strain and a suggestive food history. However, either those case-patients were lost to follow-up or information from supermarket grinding logs was found to be incomplete or partly inaccurate.

Box 1. Product information to assist FSIS with product traceback

- Who?
  - FSIS establishment number, e.g., inside USDA seal
- When?
  - Production date or lot number
  - Sell by/use by date
  - Purchase date
- What?
  - Product name and type, e.g., "90 percent lean ground beef"
  - Product weight and units per case
  - Amount of product purchased
- Where?
  - Point of purchase, including name and complete address
- Does the consumer have purchase receipts?
- Did the consumer use a shopper card for the purchase?
- Is there any leftover product held by consumer?
- Are there other sources of the same product?

COLLABORATIONS AND RESOURCES

FDIB becomes aware of foodborne illnesses in a variety of ways, including reports from the FSIS Consumer Complaint Monitoring System; local, state, and territorial public health departments; and federal agencies such as CDC and the Food and Drug Administration (FDA). FDIB also utilizes information from PulseNet, a national molecular subtyping network coordinated by CDC and comprised of laboratories at state and local public health departments, FSIS, and FDA, to detect clusters of illnesses *(8)*. The Outbreaks Section of the Eastern Laboratory (OSEL) within FSIS routinely conducts PFGE analysis and uploads patterns to PulseNet. Surveillance for foodborne illnesses is an ongoing and daily process within FDIB.

At federally inspected establishments, FSIS routinely samples raw ground beef, beef manufacturing trimmings, and selected ready-to-eat (RTE) products, such as cooked beef patties and dry fermented sausages, for *E. coli* O157:H7 *(6)*. Additionally, all RTE meat and poultry products, and pasteurized egg products, are tested for *Salmonella* and *Listeria monocytogenes*. Raw meat and poultry products that test positive for *Salmonella* collected as part of the Pathogen Reduction-Hazards Analysis Critical Control Points (PR-HACCP) performance testing program *(5)* are also compared to PulseNet.

FSIS investigators also conduct in-commerce surveillance activities to ensure that meat, poultry, and egg products in commerce are safe, wholesome, correctly labeled and packaged, and secure from intentional acts of contamination. For example, FSIS investigators collect samples of raw ground beef for *E. coli* O157:H7 testing when the retail store that ground it fails to record the identity of its suppliers *(4)*.

During foodborne illness investigations, FDIB relies on OSEL to query the PulseNet database for updated PFGE information to guide and address the critical laboratory components of the investigation. FDIB works closely with FSIS microbiologists to review non-FSIS laboratory methods and interpret laboratory findings, such as PFGE and multi-locus variable-number tandem repeat analysis (MLVA).

Local, state, and territorial public health agencies interview case-patients to establish an epidemiologic association between exposure and illness. When alerted to a report of foodborne illnesses, FDIB typically collaborates with foodborne disease epidemiologists, but may also work directly with local or territorial health and agriculture departments, when appropriate. During multi-state foodborne outbreak investigations, FDIB may coordinate activities with epidemiologists at CDC. Epidemiologists collect case-patient information and perform analytic studies to determine the source and vehicle of foodborne illnesses.

FDIB relies on field investigators to complete the essential product identification and verification methods, as well as traceback investigations. Epidemiologic, laboratory, and environmental health information collectively play an integral part in determining whether FSIS is able to take a regulatory action during an outbreak investigation.

FSIS TRACEBACK INVESTIGATION DATA NEEDS

FDIB requests information to establish temporal and spatial relationships between illnesses and regulated products and reviews available epidemiologic information to determine the strength of association. In addition, FSIS field investigators are required to review and re-assess information in order to allow the Agency to make factual determinations about regulated products in commerce.

Foods that are inspected and passed by FSIS receive a mark of inspection containing an establishment number. Finding information, such as establishment name and number, during a traceback greatly enhances the Agency's ability to trace the implicated product back to its original supplying establishment. However, other identifying information, such as product name and type, product lot code or sell by/use by date, and purchase location and date, is important to FSIS for traceback or trace-forward activities (Box 1).

CONCLUSION

FDIB is staffed by a multidisciplinary team of public health professionals who utilize a variety of resources to conduct foodborne illness investigations. FDIB examines and evaluates epidemiologic, laboratory, and traceback information to determine if an association exists between illnesses and regulated product. When FSIS-regulated products are associated with illnesses, collaboration between FDIB and public health partners reduces the burden of illnesses caused by foodborne pathogens. FSIS oversees and coordinates voluntary recalls of meat and poultry products with official establishments by ensuring that contaminated products are removed from commerce. The Agency may also conduct intensified verification testing and/or comprehensive assessments of the food safety system at the producing establishments.

Lessons learned from FSIS' involvement in outbreak investigations have in part influenced the Agency's *E. coli* O157:H7 policies in many ways. The new risk-based approach to control *E. coli* O157:H7 is one such example. This approach involves volume-based production sampling, enhanced traceback activities and intensified sampling, and investigation at the identified slaughter establishments. The first initiative changes the sampling frequency for establishments that produce ground beef products. The Agency collects samples from establishments producing higher volumes of ground beef more frequently than those producing lower volumes. Outbreak investigations have shown that products from higher volume producers are generally more widely distributed; thus, contaminated products from these producers will have a greater public health impact. Traceback activities are enhanced to determine the source of the contamination. All ground beef products testing positive for *E. coli* O157:H7 are traced back to the originating slaughter establishment. For these slaughter establishments, there will be follow-up sampling along with a thorough review of their HACCP/SSOP (Sanitation Standard Operating Procedures) for that particular product to identify issues warranting further investigation *(3, 5)*.

In response to some of the difficulties public health partners experienced in determining whether recalled products were distributed in their state, FSIS made improvements to enhance the recall process. In August 2008, through passage of the final rule, *Availability of Lists of Retail Consignees during Meat or Poultry Product Recalls,* the Agency now makes available to the public via its Web site a list of the retail consignees of meat and poultry products distributed to the retail level for Class I recalls. This change enables public health partners and consumers to identify where recalled products were distributed through retail facilities in their state *(2)*.

This *E. coli* O157:H7 investigation, used as an example, highlights the importance of inter-agency communication and coordination. When public health partners were able to provide product information from purchase receipts or shopper cards from case-patients, this accurate documentation greatly facilitated traceback, leading to the identification of the establishment that had produced the contaminated ground beef. Procedures used to obtain receipts and/or shopper card information should be adopted by health departments, as a means to obtain accurate purchase information during investigations.

During this investigation, aggressive information gathering and extensive epidemiologic investigations by public health partners helped inform FSIS about the scope of product adulteration, which led to expansion of recall activities. These collaborations between state and federal agencies during outbreak investigations are instrumental in obtaining the information needed to initiate voluntary recalls of adulterated product. Through FSIS' involvement in outbreak investigations, the Agency has gained a wealth of knowledge of the ecology of *E. coli* O157:H7 in ground beef products. This knowledge has been crucial in informing new policies that may ultimately have an impact on prevention and control of this pathogen.

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