



Epi notes

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Outbreak of Shiga toxin-producing *E. coli* (STEC) infections associated with the State Fair – North Carolina, 2011.

On Oct. 24, 2011, the Division of Public Health learned of four cases of shiga toxin-producing *Escherichia coli* (STEC) in Wake County, with a second case reported on Oct. 25. Two of these initial cases had developed hemolytic uremic syndrome (HUS), a severe complication that can occur with STEC infections. This notification began a busy three weeks for the Epidemiology Section, including the North Carolina State Laboratory of Public Health (NCSLPH), Communicable Disease Branch (CDB) and Public Health Preparedness and Response (PHP&R).

Roles and Responsibilities

In addition to providing sample collection kits to local health departments upon request, the role of NCSLPH was to confirm and characterize *Escherichia coli* O157:H7 (EC O157:H7) from clinical materials or isolates submitted to the laboratory. The NCSLPH performs cultures on selective and non-selective media, biochemical reactions, serological reactions, pulsed-field gel electrophoresis (PFGE) and multi-locus variable number tandem repeat analysis (MLVA) to isolate, identify and DNA fingerprint *E. coli* O157:H7. DNA fingerprinting of isolates was critical to separate outbreak cases from sporadic or unrelated cases occurring during the same time-period.

Initially, the role of epidemiologists in CDB was to provide support to Wake County Health Department investigators and assistance in interviewing potential case-patients to elucidate the source of exposure. As the scope of the outbreak expanded beyond Wake County, the epidemiologists in CDB assumed a larger role in coordinating the investigation. In order to facilitate case finding, active surveillance was conducted by hospital-based public health epidemiologists in the PHE network and alerts were sent to North Carolina clinicians, local health departments and microbiology

laboratories. When it became evident that the 2011 North Carolina State Fair was the only common link among cases, a matched case control study was initiated to assess potential exposures at the fair. The CD Branch developed a detailed questionnaire, interviewed cases and controls, and analyzed the data.

The role of PHP&R was to provide support to the investigation by opening the Public Health Coordination Center and filling key roles in the incident command structure, including planning, logistics, finance and communications. Because of the long hours spent investigating this outbreak, including weekend work, accounting for each staff person's time was critical in order to make an accurate assessment of time and money spent on the investigation. As a part of logistics, PHP&R ensured that staff working during the weekend had lunch available and prepared the call center for possible use during the investigation. Updating and distributing the incident action plans and daily situation reports were other key responsibilities filled by PHP&R.

NCSLPH Laboratory Investigation

The Enteric Bacteriology laboratory isolates and identifies *E. coli* O157:H7 by plating a stool sample

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on selective media such as Sorbitol-MacConkey and Chromagar in order to identify sorbitol negative colonies. In addition, an enrichment broth is set up for subsequent shiga toxin testing. Sorbitol negative colonies are then tested for reactivity with O157 and H7 antisera. Biochemical reactions on Triple Sugar Iron (TSI) and Lysine Iron Agar (LIA) plus others are used to confirm *E. coli* O157:H7 as well.

Suspect *E. coli* O157:H7 isolates are provided to the Molecular Epidemiology group for DNA fingerprinting. The gold standard method is PFGE, which takes three days to complete (including the sample preparation, electrophoresis and banding pattern analysis). NCSLPH uses standard methods provided by CDC as part of PulseNet so that results from North Carolina bacterial isolates can be compared to isolates across the nation via electronic means. In this way, potential sources of foodborne illness can be rapidly identified. In addition to PFGE, NCSLPH uses another rapid method known as MLVA to provide additional information about the similarity of isolates. In this outbreak, *E. coli* O157:H7 was isolated from 11 case-patients; both PFGE and MLVA demonstrated that all 11 isolates had very similar DNA fingerprints.

Case Control Study

During the outbreak investigation, it became clear that all cases had visited the State Fair, held during Oct.13-23. Close collaboration with partners in the N.C. Department of Agriculture & Consumer Services (NCDA&CS) throughout the investigation was critical in solving the puzzle regarding which exposure(s) at the State Fair likely led to illness. NCDA&CS provided maps that indicated which events occurred on which days at each location on the fairgrounds. The Environmental Health Section in the Division of Public Health also provided maps showing locations of all the food vendors. With the help of NCDA&CS, over 31,000 email addresses from patrons who pre-purchased tickets online were provided to the public health investigation team. Emails were sent to 11,000 randomly selected patrons from this list to request participation. A link was included to a brief survey asking about their willingness to participate, age and dates of state fair attendance. Of more than 1,000 people who responded that they were willing to participate, 77 were randomly selected and matched to cases based on age (<18, ≥18) and date of fair attendance. This unique approach greatly facilitated the rapid enrollment of three controls for each case,

providing the statistical power needed to maximize our ability to identify the source.

Outcomes

Thanks to the strong partnerships within the Epidemiology Section and with NCDA&CS and Wake County Health Department, the outbreak investigation was concluded on Nov. 9. Results of the investigation were shared with all partners and a public announcement was made on Nov. 10 by Public Health, NCDA&CS and Wake County. Results of the investigation indicated that the exposure likely occurred in the Kelley Building – a permanent structure that housed sheep, goats and pigs during the State Fair and was a livestock competition venue. No other exposures were associated with illness. As a result of this investigation, a multiagency task force is being created by NCDA&CS to evaluate the lessons learned from the 2011 State Fair and to identify additional steps that could be taken to minimize the risk of future outbreaks.

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