



# Morbidity and Mortality Weekly Report (MMWR)

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## Outbreak of Invasive Listeriosis Associated with Consumption of Hog Head Cheese --- Louisiana, 2010

### Weekly

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During January--June 2010, a total of 14 cases of laboratory-confirmed invasive listeriosis were reported to the Louisiana Office of Public Health (OPH). Isolates of *Listeria monocytogenes* from the blood samples of eight patients were identified as serotype 1/2a and had pulsed-field gel electrophoresis (PFGE) pattern combinations that were indistinguishable from one another. The detection of this cluster prompted an investigation in coordination with CDC, the Louisiana Department of Agriculture and Forestry (LDAF), and the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS). In-depth epidemiologic and environmental investigations of the cluster were initiated on July 26, including food history interviews of four patients. Three patients reported eating hog head cheese (a meat jelly made from swine heads and feet); the product was purchased at two grocery stores in Louisiana. A traceback investigation determined that a single brand of hog head cheese was common between the two grocery stores. *L. monocytogenes* serotype 1/2a was cultured from one of three product samples and from two of 16 environmental samples collected by LDAF at the processing establishment; the product and one of the two environmental samples yielded isolates with PFGE pattern combinations that were indistinguishable from the patient isolates. On August 14, LDAF coordinated a voluntary recall of approximately 500,000 pounds of hog head cheese and sausage because of possible contamination with *L. monocytogenes*. This is the first published report of an invasive listeriosis outbreak associated with hog head cheese, which is a ready-to-eat (RTE) meat. USDA-FSIS has a "zero tolerance" policy for *L. monocytogenes* contamination of RTE food products (1), requesting recall of such products at any detectable level of *L. monocytogenes* contamination. LDAF imposes and enforces equivalent requirements in state-inspected establishments.

Invasive listeriosis has been nationally notifiable since 1999. In 2003, the Council of State and Territorial Epidemiologists recommended prompt, routine interviews of all patients using a standardized questionnaire and forwarding all *L. monocytogenes* isolates from clinical laboratories for PFGE subtyping at public health laboratories (2). Accordingly, the Louisiana OPH collects demographic and clinical information for all reported cases of invasive listeriosis. Patients are interviewed immediately for food histories using CDC's Listeria Initiative questionnaire.\* Patient isolates are sent to the Public Health Central Laboratory at OPH for confirmation and PFGE characterization.

Louisiana OPH epidemiologists noted that 14 cases of invasive listeriosis had been reported during January--June 2010, which exceeded the state's average of five cases reported during each January--

June period during the previous 3 years. For this investigation, a cluster-associated case was defined as isolation of *L. monocytogenes* serotype 1/2a from a normally sterile site (e.g., blood or cerebrospinal fluid) or from placental or fetal tissue (in the setting of miscarriage or stillbirth) since January 1, 2010, and PFGE pattern combination GX6A16.0001 and GX6A12.0001.

Eight patients had illnesses that met the case definition. Their median age was 64 years (range: 38--93 years). Six patients were men; no patients were pregnant. Six patients had one or more underlying medical conditions (i.e., human immunodeficiency virus [HIV] infection, alcohol abuse, cancer, and diabetes mellitus). Illness onsets occurred from February 18 to June 16 (Figure). Signs and symptoms included fever (n = 6 patients), altered mental status (n = 3), diarrhea (n = 3), vomiting (n = 3), and weakness (n = 2). Seven patients were hospitalized; two patients died.

OPH epidemiologists obtained food histories from four patients; the remaining patients could not be reached for interview because of their illness or death. Two patients initially reported eating hog head cheese purchased from the same grocery store. Upon re-interview, a third patient also reported eating hog head cheese purchased from a grocery store in another city. A fourth patient could not be reached for re-interview but had initially reported eating "other deli meats," a category that would include hog head cheese. The traceback investigation determined that only one brand of hog head cheese was sold at both stores, suggesting that this brand was the outbreak source.

OPH sanitarians conducted an environmental investigation at both grocery stores to gather additional information on the suspect product. The sanitarians determined that hog head cheese offered for sale arrived in small, 0.7 pound blocks that were individually vacuum-sealed at the processing establishment. Each store weighed and priced the product and sold it in the refrigerated meat section. The sanitarians collected one unopened package of mild hog head cheese from the first store and two unopened packages of hog head cheese, one mild and one spicy, from the second store. At CDC's Enteric Diseases Laboratory Branch, *L. monocytogenes* serotype 1/2a with the outbreak PFGE pattern combination was isolated from the package of spicy hog head cheese.

This finding triggered a voluntary recall of approximately 500,000 pounds of hog head cheese and sausage that was processed on the same equipment. LDAF also collected 16 environmental samples from the processing establishment. Cultures of samples from a refrigeration unit and a door threshold yielded *L. monocytogenes*. An isolate from the refrigeration unit exhibited the outbreak PFGE pattern combination, and an isolate from the door threshold exhibited a pattern combination that was new to the PulseNet database (GX6A16.1362 and GX6A12.1939). CDC and the USDA Agricultural Research Service further characterized the patient, product, and environmental isolates using multiple-locus variable-number tandem repeat analysis and multilocus genotyping (3). All isolates, with the exception of the isolate from the door threshold, displayed indistinguishable multiple-locus variable-number tandem repeat analysis patterns and identical multilocus genotyping haplotypes (2.12\_1/2a), further strengthening the association between the outbreak-associated cases and the hog head cheese producer.

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## Editorial Note

*L. monocytogenes* can be found in soil, water, and silage, and causes a spectrum of illness ranging from asymptomatic infection to severe disease in both animals and humans. Invasive listeriosis, including sepsis and meningoenzephalitis, occurs predominantly in older adults, persons with impaired immune systems, fetuses, and neonates. Based on its ubiquitous nature and the ability of the bacterium to establish itself in food processing environments, *L. monocytogenes* presents unique challenges for the food industry and regulatory agencies in their efforts to prevent the contamination of RTE foods. In addition, unlike most foodborne pathogens, *L. monocytogenes* can multiply at refrigerator temperatures.

Most cases of invasive listeriosis in the United States are sporadic (4). However, the advent of PulseNet for molecular subtyping of foodborne bacterial pathogens has revolutionized the ability of public health and regulatory officials to detect clusters and outbreaks and trace them to their sources (5). PulseNet is a network of laboratories in local, state, and federal health and regulatory agencies that use standard protocols, equipment, and nomenclature to upload PFGE patterns into a central database for comparison with one another. For *L. monocytogenes*, this usually consists of two patterns per isolate (i.e., images resulting from the use of two restriction enzymes, *Ascl* and *Apal*). In Louisiana, when OPH epidemiologists noted an unusually high listeriosis case count in 2010, PulseNet showed through molecular subtyping that eight cases were related, prompting the investigation.

Epidemiologic investigations of listeriosis clusters are challenging because case counts often are relatively small, some patients might not be available for interview, and others frequently report consumption of common food items that are higher-risk foods for *L. monocytogenes* contamination (6). In addition, the lengthy and variable incubation period of listeriosis (3--70 days) can result in recall bias and difficulty establishing an appropriate exposure period for food histories (7). Finally, immunocompromised persons who would be suitable controls for matched case-control studies often are difficult to identify. To address these challenges, CDC established the Listeria Initiative in 2004 to aid investigations of listeriosis clusters by using a standardized, extended case-form questionnaire to obtain timely food exposure histories from all persons with listeriosis reported in the United States (2). Patients are interviewed once illness is confirmed (rather than waiting for cluster detection). Using the Listeria Initiative questionnaire and associated database, hog head cheese was recognized as an uncommon food item that was common among the patients.

The implicated brand of hog head cheese originated from a small, state-inspected processing establishment in Louisiana, which produces approximately 600 pounds of hog head cheese per week. This establishment was under federal inspection until January 2007. Routine FSIS microbiologic testing of products at the establishment detected *L. monocytogenes* contamination in October and December 2006; the company voluntarily recalled 290 pounds of hog head cheese in January 2007. Four *L. monocytogenes* isolates from USDA-FSIS samples collected in 2006 did not match the 2010 outbreak-related PFGE pattern combination. In addition, *Listeria* contamination was not detected in any of the 12 product samples collected by LDAF since 2007; analysis of routine environmental samples collected by the management of the processing establishment during January--July 2010 also did not detect *Listeria*. However, the outbreak strain was identified in environmental samples collected during the investigation, which was several weeks after the manufacture of the outbreak-associated products (Figure), suggesting that persistent environmental contamination in the processing establishment was responsible for product contamination and resulting illnesses.

USDA-FSIS and state-inspected, meat-producing and poultry-producing establishments are required to develop a hazards analysis critical control points (HACCP) plan to prevent or eliminate reasonable hazards (including *L. monocytogenes* contamination of RTE products) using effective interventions. An FSIS risk assessment (8) determined that using combinations of interventions (e.g., testing and sanitation of food contact surfaces, prepackaging and postpackaging interventions, and the use of growth inhibitors) was more effective than any single intervention. The Listeria Rule† encourages establishments producing RTE products subject to postlethality contamination (e.g., contamination after cooking) to introduce combinations of interventions to eliminate and prevent the growth of *L. monocytogenes* in their products. Establishments choosing not to introduce such interventions or to only introduce growth inhibitors are required to test food contact surfaces for *Listeria* and are subject to more frequent product and surface sampling by the regulatory agency.

Although this is the first report of a listeriosis outbreak associated with the consumption of hog head cheese, RTE deli meats are a recognized vehicle for *Listeria* infection and have been associated with several past outbreaks in the United States (9). Persons at risk for listeriosis, including older adults, pregnant women, and persons with immunocompromising conditions or therapies, should take additional precautions to lower their risk for infection.§ CDC, USDA-FSIS, and FDA have developed food safety education guidance for persons at risk for listeriosis and those who prepare meals for at-risk persons (Box).

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† Additional information available at <http://www.fsis.usda.gov/oppde/rdad/frpubs/97-013f.htm> ☞.

§ Additional information available at <http://www.cdc.gov/nczved/divisions/dfbmd/diseases/listeriosis>.

### What is already known on this topic?

Multistate outbreaks of listeriosis led to U.S. regulatory policy changes and industry controls of *Listeria monocytogenes* contamination in ready-to-eat (RTE) meat and poultry products.

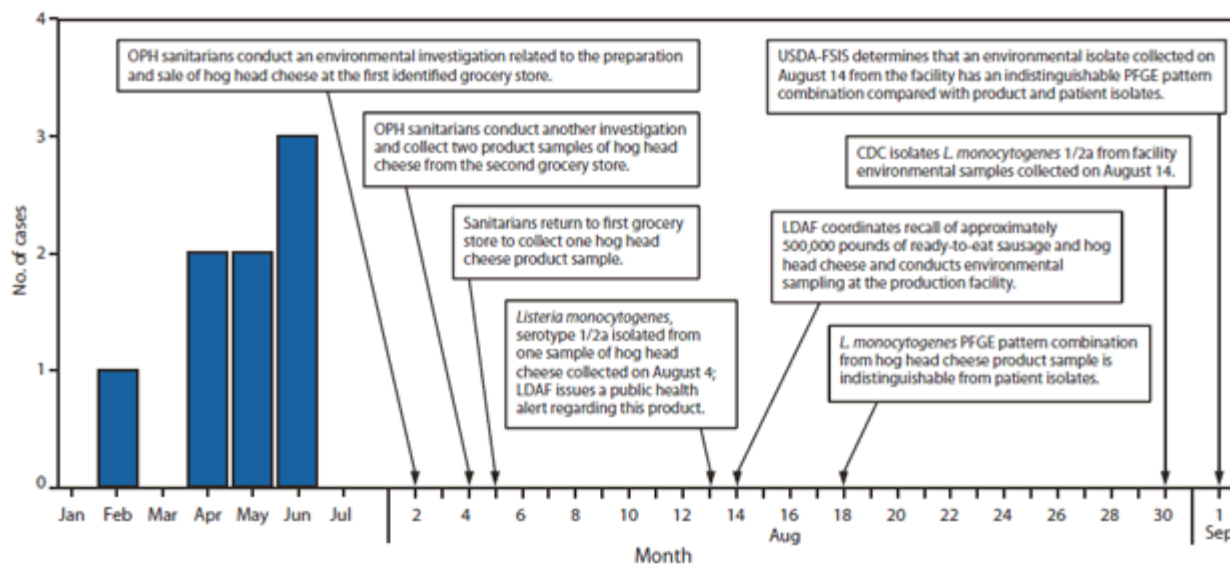
### What is added by this report?

This is the first report of an association between an outbreak of invasive listeriosis and hog head cheese, indicating continuing challenges for RTE meat processors to prevent *L. monocytogenes* contamination, and the vulnerability of at-risk populations to invasive infections through consumption of contaminated RTE meat.

### What are the implications for public health practice?

The combined application of PulseNet, a molecular subtyping network, and the Listeria Initiative, an enhanced surveillance program, was indispensable for the outbreak investigation and subsequent identification and recall of potentially contaminated product.

**FIGURE. Number of invasive listeriosis cases, by month of patient specimen collection, and investigation timeline after an outbreak associated with consumption of hog head cheese --- Louisiana, 2010**



**Abbreviations:** OPH = Louisiana Office of Public Health; LDAF = Louisiana Department of Agriculture and Forestry; PFGE = pulsed-field gel electrophoresis; USDA-FSIS = U.S. Department of Agriculture Food Safety and Inspection Service.

**Alternate Text:** The figure above shows the number of invasive listeriosis cases, by month of patient specimen collection, and investigation timeline, after an outbreak associated with consumption of hog head cheese in Louisiana in 2010. Illness onsets occurred from February 18 to June 16.

### BOX. Guidance for listeriosis prevention among persons at risk

Eating food contaminated with the bacterium *Listeria monocytogenes* can cause a potentially life-threatening, invasive disease called listeriosis. Pregnant women, older adults, and persons with weakened immune systems caused by medical conditions or treatment are at higher risk for listeriosis. Symptoms include fever, headache, stiff neck, confusion, loss of balance, and convulsions. Pregnant women might experience only mild illness; however, listeriosis during pregnancy can lead to miscarriage or stillbirth, premature delivery, or life-threatening infection of the newborn.

CDC, the U.S. Department of Agriculture (USDA) Food Safety and Inspection Service, and Food and Drug Administration recommend that at-risk persons and those who prepare meals for at-risk persons adhere to the following guidance.

#### Pay attention to the following foods and advice:

Do not eat hot dogs, lunch meats, cold cuts, other deli meats (e.g., bologna), or fermented or dry sausage, unless they are reheated to 165°F (74°C) or until steaming hot just before serving.

Do not eat refrigerated pâté or meat spreads from a deli or meat counter or from a refrigerated section of the store. Foods that do not need refrigeration, such as canned or shelf-stable pâté and meat spreads, are safe to eat. Refrigerate after opening.

Do not eat refrigerated smoked seafood, unless it is contained in a cooked dish, such as a casserole, or unless it is a canned or shelf stable product. Refrigerated smoked seafood, such as salmon, trout, whitefish, cod, tuna, or mackerel, is most often labeled as “nova-style,” “lox,” “kippered,” “smoked,” or “jerky.” The fish is found in the refrigerator section or sold at seafood and deli counters of grocery



stores and delicatessens. Canned and shelf stable tuna, salmon, and other fish products are safe to eat.

Do not drink raw (unpasteurized) milk, and do not eat foods that have unpasteurized milk in them.

Do not eat soft cheese such as feta, queso blanco, queso fresco, brie, Camembert, as well as blue-veined cheeses, and panela cheese (queso panela) unless it is labeled as made with pasteurized milk. Make sure the label says, "Made with pasteurized milk."

### **To keep food safe:**

Use a refrigerator thermometer to check the refrigerator's inside temperature. The refrigerator should be 40°F (4°C) or lower, and the freezer should be 0°F (-18°C) or lower.

*Listeria monocytogenes* can grow in the refrigerator. Use a refrigerator thermometer to check the refrigerator's inside temperature. The refrigerator should be 40°F (4°C) or lower, and the freezer should be 0°F (-18°C) or lower.

Clean up all spills in the refrigerator right away, especially juices from hot dog and lunch meat packages, raw meat, and raw poultry.

Clean the inside walls and shelves of the refrigerator with hot water and liquid soap, then rinse.

Divide leftovers into shallow containers to promote rapid, even cooling. Cover with airtight lids or enclose in plastic wraps or aluminum foil. Use leftovers within 3 to 4 days.

Use precooked or ready-to-eat food as soon as possible. Do not store the product in the refrigerator beyond the use-by date; follow USDA refrigerator storage time guidelines:

-- Hot dogs: store opened package no longer than 1 week and unopened package no longer than 2 weeks.

-- Lunch and deli meat: store factory-sealed, unopened package no longer than 2 weeks. Store opened packages and meat sliced at a local deli no longer than 3 to 5 days.

### **Follow these four simple steps:**

1. **Clean:** Wash hands and surfaces often. Wash hands often with soap and warm water, especially after touching hot dogs, raw meat, chicken, turkey, seafood, or their juices. Use clean dishes, spoons, knives, and forks. Wash countertops with hot soapy water and clean up spills right away. To keep cutting boards clean, wash them with hot, soapy water after each use. If sanitizing a cutting board, use a solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water to flood the surface of the cutting board; allow it to stand for several minutes. Rinse with clear water and air or pat dry with clean paper towels.
2. **Separate:** Do not cross-contaminate. Keep raw meat, fish, and poultry away from other food that will not be cooked. Use one cutting board for fresh produce and bread and a separate one for raw meat, poultry, and seafood. Never place cooked food on a plate that previously held raw meat, poultry, seafood, or eggs without first washing the plate with hot soapy water. Do not reuse marinades used on raw foods unless they are brought to a boil first.
3. **Cook:** Cook to proper temperatures. Use a food thermometer to ensure that food is cooked to a safe minimum internal temperature. Cook ground beef or pork to 160°F (71°C), poultry to 165°F (74°C), and seafood to 145°F (63°C). Cook shrimp, lobster, and crab until they turn red and the

flesh is pearly opaque. Cook clams, mussels, and oysters until the shells open. Cook eggs until the yolks and whites are firm. Use only recipes in which the eggs are cooked or heated to 160°F (71°C).

4. **Chill:** Refrigerate promptly. Refrigerate or freeze within 2 hours; refrigerate or freeze within 1 hour in hot weather ( $\geq 90^{\circ}\text{F}$  [ $\geq 32^{\circ}\text{C}$ ]). Do not leave meat, fish, poultry, or cooked food sitting out. Purchase perishable foods last, and go directly home from the grocery store. In hot weather, take a cooler with ice or another cold source to transport foods safely.

Additional food safety guidance for at-risk persons and multi-language publications are available at [http://origin-www.fsis.usda.gov/fact\\_sheets/at\\_risk\\_&\\_underserved\\_fact\\_sheets/index.asp](http://origin-www.fsis.usda.gov/fact_sheets/at_risk_&_underserved_fact_sheets/index.asp).

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