March 2026 Vol. 46, No. 2

Connecticut Epidemiologist

CONNECTICUT
PUBLIC HEALTH

Devil in the Details: Outbreak of Listeriosis Associated with a Food Establishment—Connecticut, 2024

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Background

Listeria monocytogenes is a bacterium that can cause a severe illness called listeriosis. Listeriosis is usually acquired through foodborne transmission. Older adults, people with weakened immune systems, and pregnant women and their newborns are at highest risk of listeriosis. Nearly everyone with listeriosis is hospitalized with a case-fatality rate of about 20%. The Centers for Disease Control and Prevention (CDC) estimates that listeriosis is the third leading cause of death from foodborne illness in the United States (US) with about 172 deaths per year.[1]

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Outbreaks of listeriosis are rare. Between 2010–2023 there were ten multistate outbreaks involving Connecticut (CT) residents. Past outbreaks in the US have been linked to milk and cheeses, ice cream, fruits and vegetables, deli meats, supplement shakes, and ready-to-eat foods.[2]

In CT, laboratories that identify *L. monocytogenes* are required to report it to CT Department of Public Health (DPH) and to send the isolate to the DPH Laboratory (CT DPHL) for further characterization. Two or more isolates that are linked using whole genome sequencing (WGS) are investigated as a cluster, which would be considered an outbreak if a common source is identified.

On November 8, 2024, the CT DPH Epidemiology and Emerging Infections Program (EEIP) was notified by the CT DPHL of two *Listeria* cases linked by WGS. The DPH EEIP, DPH Food Protection Program (FPP), Yale Emerging Infections Program (EIP), and the Local Health Department (LHD) collaborated to investigate the outbreak and implement control measures.

Epidemiologic Investigation

The outbreak included two cases who were >75 years of age and who lived in the same CT city; one case was male. Case 1 had symptom onset in August 2024; symptoms included shortness of breath, stiff neck, altered mental status, headache, and myalgia. Case 2 had symptom onset in October 2024; symptoms included fever and dizziness. Both cases were hospitalized and both survived. Interviews of case-patients using CDC's *Listeria* Initiative Case Report Form were conducted with surrogates that were familiar with what the case-patients ate. Both cases were reported to have eaten deviled eggs and fried chicken from the same food establishment (FE). No other common foods from this FE were reported during interviews although coleslaw was listed on the menu as a side item included with all fried chicken dinners.

Environmental Investigation

On November 14, 2024, the LHD conducted an onsite investigation and product sampling at the FE. During the site visit, four containers of deviled eggs, four containers of plain hard-boiled eggs, and four containers of coleslaw were collected and submitted to DPHL for testing. An assessment of deviled egg preparation steps was also performed. Inadequate hot water temperature for hand washing was observed at the 3-bay and hand sinks.

On November 26, 2024, the LHD returned to the FE, along with the DPH FPP for additional product and environmental sampling. Twelve environmental swabs were collected along with additional deviled egg samples from the walk-in cooler, an unopened container of mayonnaise, and an open container of mustard. Additionally, FPP conducted observation of food-handling practices. After discussion with the LHD, the FE voluntarily stopped production of deviled eggs and all deviled eggs that were previously prepared were voluntarily discarded.

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After consulting with CDC, Food and Drug Administration (FDA), and the New York Integrated Food Safety Center of Excellence, a third on-site visit was conducted at the FE on December 30, 2024, by FPP, DPHL, and LHD staff.[3] Twenty-nine environmental samples were taken. Food samples were taken of raw eggs, plain hard-boiled eggs, and deviled eggs that had been prepared during the site visit under observation of DPH and LHD. Deficiencies identified included minimal hand washing by staff, an inaccessible hand sink, re-use of single use articles that are not cleanable, and inadequate cleaning and sanitizing of kitchenware due to lack of sanitizer. The 2-bay sink was clogged resulting in backflow and lack of drainage. It was observed that when the hard-boiled eggs were poured into a colander to drain in the 2-bay sink, the water initially drained but then regurgitated from the clogged drain and splashed onto the eggs in the colander. The sink trap was disassembled which revealed a severe blockage of mainly breadcrumbs and flour. There was no designated mop sink at the FE, as required by the FDA Food Code; staff reported that they dumped mop water into the 3-bay sink, which is also used to wash, rinse, and sanitize foodservice equipment. Thorough swabbing inside the sink drains was difficult because the drain grates were not removable. Additionally, there was no existing cleaning schedule or written standard operating procedures for sanitization.

Laboratory Investigation

Forty-one environmental samples, 12 food samples, and two case-patient clinical isolates were submitted to the DPHL for testing. The *L. monocytogenes* in the two clinical isolates had a 0 allele difference by WGS (Figure 1). *L. monocytogenes* was isolated in four food samples that were collected during the first and second visits to the FE (three deviled eggs and one plain hard-boiled egg). All three isolates from deviled egg samples had a 0 allele difference from the clinical isolates by WGS. The one plain hard-boiled egg isolate differed from the clinical isolates by 0–1 alleles. *L. monocytogenes* was isolated in two environmental samples (mop and 3-bay sink). The mop sample was closely related to the outbreak strain by 0–1 alleles. The *L. monocytogenes* isolate from the 3-bay sink was not closely related to the outbreak strain.

Discussion

This was the first outbreak of listeriosis in CT that could be linked to a FE. Sources of listeriosis outbreaks have historically been difficult to identify because they are often small and incubation periods are frequently long. In this outbreak, the typing of patient isolates using WGS by the DPHL resulted in the identification of a link between two cases distant in time that might not have otherwise been made. WGS has increased the number of clusters detected and reduced the cluster size compared to previous typing methods.[4]

Once the cluster was identified, close multidisciplinary state and local public health collaboration then lead to the identification of the source of exposure and the implementation of control measures. Thorough routine interviews of case-patient proxies allowed for rapid detection of the shared FE and food exposures. Extensive environmental and laboratory investigation, including WGS testing of foods and the environment, provided conclusive evidence that the FE was the source of the outbreak, identified contributing factors that likely caused the outbreak, and allowed for targeted recommendations for the FE. These recommendations were extensive including instructing the FE to stop serving eggs immediately, hiring a plumber to unclog the 2-bay sink, purchasing new mops and buckets, installing a designated mop sink, developing and implementing written standard sanitation operating procedures in consultation with LHD, and hiring a professional cleaning company that specializes in *Listeria* remediation.

Listeria can persist on surfaces even after routine cleaning and sanitizing and can grow in cool temperatures.[5] *Listeria* might have continued to grow on food that had contact with contaminated surfaces at the FE even if refrigerated. Without this investigation and its resulting control measures, transmission might have continued to occur that could have resulted in severe illness and even death among vulnerable populations including older adults and people with otherwise weakened immune systems.

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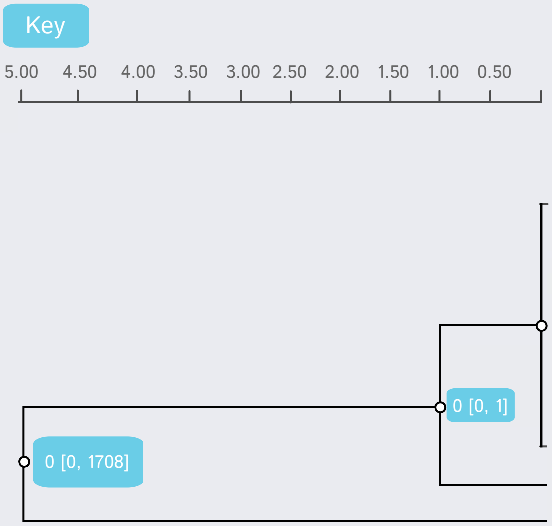
Figure 1. Phylogenetic tree of *Listeria* human, food, and environmental isolates



ID	Isolate Date	Source Type	Type Details	Source Site	MLST_ST
CT_1245159C		Human	Pleural fluid	Body fluid	ST570
CT_1257895C		Human		Blood	ST570
CT_1262847001	11/26/2024	Food	Deviled eggs	Eggs	ST570
CT_1262845001	11/26/2024	Food	Deviled eggs	Eggs	ST570
CT_1268811023	12/30/2024	Environmental		Mop	ST570
CT_1261414001-1	11/14/2024	Food	Deviled eggs	Eggs	ST570
CT_1261414001-4-1	11/14/2024	Food	Deviled eggs	Eggs	ST570
CT_1261414002	11/14/2024	Food	Boiled eggs	Eggs	ST570
CT_1268811027	12/30/2024	Environmental	Rinse sink	Sink drain	ST5

Trends in Foodborne Illnesses in Connecticut, 2018–2023

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Background

The Foodborne Diseases Active Surveillance Network (FoodNet) has tracked foodborne illnesses in Connecticut (CT) since 1996 and is a principal component of the Centers for Disease Control and Prevention's (CDC) Emerging Infections Program (EIP). FoodNet provides the foundation for food safety policies and prevention efforts by estimating the burden of foodborne illness in the United States (US), monitoring trends in specific illnesses over time, attributing illnesses to specific food items or settings, and disseminating this information to the public and health departments.[1] FoodNet is a collaboration between the CDC, United States Department of Agriculture (USDA), Food and Drug Administration (FDA), and 10 state health departments including the CT Department of Public Health (DPH).[1]

This article presents a descriptive analysis examining the patterns of sporadic foodborne illnesses in CT during 2018–2023. This time period includes the first two years of the COVID-19 pandemic (2020 and 2021) when personal movement was most restricted. The analysis aims to describe rates of infections and trends associated with foodborne illnesses caused by seven bacterial pathogens—*Campylobacter*, *Listeria*, *Salmonella*, Shiga toxin-Producing *Escherichia Coli* (STEC), *Shigella*, *Vibrio*, and *Yersinia*—and the parasite *Cyclospora*, which are all reportable diseases in CT.[1]

Methods

Positive laboratory findings for the pathogens described here are reportable to CT DPH. Data for this analysis were collected by CT DPH and the Yale EIP FoodNet program as part of follow up of cases among CT residents with positive specimens collected between January 1, 2018–December 31, 2023. Only sporadic cases (those not known to have been part of an outbreak) were included in the analysis (N = 9,242).

Annual incidence rates per 100,000 population were calculated for each pathogen by dividing the annual case count by the 2020 US Decennial Census population estimate for CT. Cases were counted in the year in which the specimen was collected. Demographic characteristics of cases (age, race/ethnicity, and sex) were examined by year of specimen collection. Select clinical and epidemiological characteristics of cases reported in

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2023 were examined including the proportion hospitalized, case-fatality ratio, the percentage reporting diarrhea or a fever, and the percentage reporting international travel during their incubation period. The year 2023 was chosen since it is the most recent and had the most complete clinical information. Statistical methods used for analysis were one-way ANOVA to identify differences in mean age of cases and chi-square for trend for changes in incidence, excluding the years 2020 and 2021 when diagnosis and exposure patterns were atypical, and for differences in race/ethnicity and sex of cases over time.

Data cleaning, management, and analysis were done in SAS 9.4 and visualizations were completed in RStudio Version 2025.05.1+513.

Results

During 2018–2023, the incidence of cases caused by all the pathogens combined showed an increasing trend, ranging from 43.01 to 51.89 per 100,000 (incidence: 2018, 43.01; 2019, 47.75; 2022, 44.20; 2023, 51.89; $\chi2 = 20.56$, $P < 0.01$ chi-square for trend). The highest incidence occurred in 2023 with 1,871 total cases of foodborne illnesses reported. *Campylobacter* and *Salmonella* were consistently the most reported foodborne illness pathogens in the state (Figure 1). The incidences of *Campylobacter*, *Shigella* and *Yersinia* all increased significantly during the period excluding 2020 and 2021 (*Campylobacter* $\chi2 = 4.93$, $P = 0.03$; *Shigella* $\chi2 = 17.14$, $P = 0.00003$; *Yersinia* $\chi2 = 10.88$, $P = 0.001$). Incidence nearly doubled from 2.44 cases per 100,000 in 2018 to 4.66 cases per 100,000 in 2023 for *Shigella* and from 1.86 cases to 3.69 cases per 100,000 for *Yersinia*. All pathogens experienced a noticeable decline in incidence in 2020, corresponding to the onset of the COVID-19 pandemic.

The mean age of individuals with reported foodborne illnesses increased during 2018–2023 from 43.5 years to 47.0 years (F statistic = 4.19, DF = 5, $P < 0.01$) (Table 1). Additionally, the distribution of cases by race/ethnicity shifted during this time period, with the proportion of cases that were non-Hispanic White decreasing from 69.6% to 62.3% between 2018–2023 ($P < 0.01$ for chi-square for trend) while the proportion of cases that were Hispanic/Latino increased from 18.3% to 23.4% ($P < 0.01$ chi-square for trend) (Table 1).

For disease severity among 2023 cases, hospitalization was most common among those with *Listeria* at 93.3% and least common among those with *Cyclospora* at 5.3% (Table 2). Similarly, the case fatality rate among cases was highest among *Listeria* cases at 26.7% (n = 4), while there were no deaths among *Cyclospora* cases.

Among 2023 cases, 57.1% of *Listeria* cases reported experiencing diarrhea compared to more than 90% of cases for all other pathogens except *Vibrio* (Table 2). Fever was most commonly reported by *Listeria* cases (93.3%) with lower proportions reported for other pathogens ranging from 17.4% for *Yersinia* cases to 51.6% for *Salmonella* cases. The percentage of cases who reported international travel in the 7 days before symptom onset also varied by pathogen, ranging from 4.7% of *Yersinia* cases to 33.3% of *Cyclospora* cases.

Discussion

The results of this analysis demonstrated several differences that occurred over the time period. First, the incidence of all the pathogens combined increased in 2023 compared to previous years, with *Campylobacter* and *Salmonella* remaining as the two leading causes of reported foodborne illnesses in the state. This finding mirrors trends seen nationally as reported by the CDC.[2, 3] Increases in overall incidence may reflect changes in testing methods, as the US has seen increased usage of culture-independent diagnostic testing (CIDT) methods to detect and identify infections that may have previously gone undetected.[3] Increases might also reflect changes in population exposures, risk factors, or other reasons.

Furthermore, there were shifts in demographic characteristics of cases. The proportion of cases who were non-Hispanic White decreased and the proportion of who were Hispanic/Latino increased from 2018 to 2023, excluding 2020 and 2021. These changes might be due to increased healthcare accessibility, changes in risk factors or exposures, or changes in the racial/ethnic makeup of the population given evidence that the Hispanic/Latino population has increased in CT.[4] Further research is needed to investigate the cause of such differences.

The COVID-19 pandemic, declared a public health emergency in March 2020 in the US, led state and local officials to implement stay-at-home orders, restaurant closures, school and child care center closures, and other public health interventions to slow the spread of SARS-CoV-2.[2] The resulting change in travel patterns, food consumption patterns, and other related exposures led to reductions in the incidence rates of foodborne illnesses overall and across all pathogens in Connecticut, similarly seen in the nationwide trends observed in 2020 in the US.[2] This decline may also partially reflect decreased detection or underreporting during the pandemic due to changes in healthcare-seeking behavior, healthcare delivery, or laboratory testing.[2]

Clinical characteristics differed by pathogen overall. In 2023, *Campylobacter*, *Salmonella*, STEC, *Yersinia*, and *Shigella* cases had high proportions of diarrhea reported (>90%), aligning with established knowledge about the gastrointestinal nature of infections with these pathogens. *Listeria* had the highest proportion of hospitalized cases while *Cyclospora* had the

Trends in Foodborne Illnesses in Connecticut, 2018–2023 *(continued)*

lowest proportion, which mirrors trends seen in the US overall, where national estimates show 97.5% of *Listeria* cases and 7.6% of *Cyclospora* cases were reportedly hospitalized.[3] Diarrhea was less commonly reported as a symptom among *Listeria* cases, but *Listeria* cases had the highest proportion of reported fever, as well as hospitalization, and death. As *Listeria* is the most severe of all these foodborne pathogens, this aligns with what is known about its symptoms and severity, which include non-gastrointestinal symptoms such as fever, muscle aches, confusion, and severe complications such as sepsis, meningitis, and death.[5]

The number of cases of foodborne illnesses included in this analysis likely represent only the most severe cases in the population and underestimate the true disease burden in CT. Severity of foodborne illnesses varies from person-to-person, therefore individuals who may have milder symptoms or clear the infection on their own may not seek out healthcare or get tested for their illness and therefore would not be reported to the state as a case.

These results support the continued need for active public health surveillance of foodborne illnesses in CT. The increases in overall incidence and pathogen-specific incidence highlight the need for identification of reasons for such increases, which may be related to exposure or risk factors, healthcare access, or an increase in CIDT usage in recent years. Changes in demographic patterns, particularly the decline in cases among non-Hispanic White people and increase among the Hispanic/Latino population, may in part reflect population changes in CT, but further investigation is needed. Continued public education on safe food storage, handling practices, and preparation can help prevent such illnesses, along with education on proper hand hygiene to prevent further spread and transmission to other individuals.

Acknowledgements

Thank you to Dr. James Hadler for his guidance on this article, and the Connecticut Emerging Infections Program FoodNet and FoodCORE team including those at the Connecticut Department of Public Health, for the data collection.

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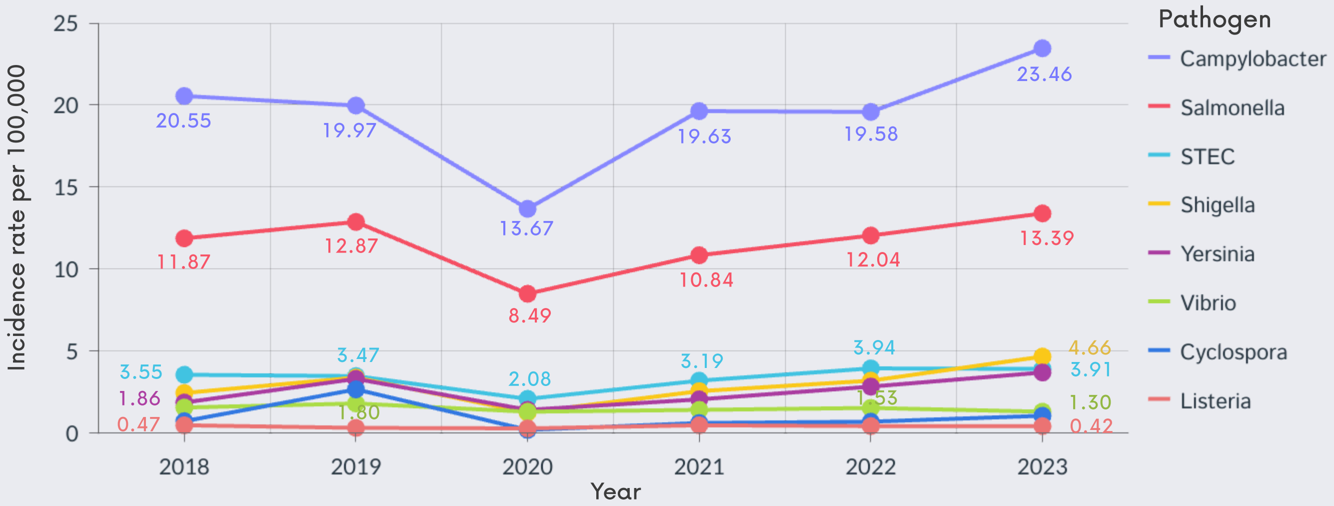
Figure 1. Incidence rates per 100,000 by pathogen, 2018–2023



Trends in Foodborne Illnesses in Connecticut, 2018–2023 *(continued)*

Table 1. Demographic characteristics of individuals with foodborne illnesses in Connecticut, 2018–2023 (N = 9,242)

Characteristic	**Year**						
	2018	2019	2020	2021	2022	2023	P Value
	(N=1,551)	(N=1,722)	(N=1,034)	(N=1,407)	(N=1,594)	(N=1,871)	
Age mean ± SD	43.5 ± 23.6	44.2 ± 24.2	44.9 ± 25.4	45.4 ± 25.4	45.2 ± 25.0	47.0 ± 24.1	<0.01**
Sex							
Female	763 (49.2)	885 (51.5)	537 (51.6)	722 (49.2)	814 (51.1)	935 (50.0)	NS
Male	788 (50.8)	835 (48.6)	500 (48.4)	747 (50.9)	780 (48.9)	936 (50.0)	NS
Race/Ethnicity							
Non-Hispanic White	1,002 (69.6)	1,092 (69.5)	620 (67.9)	852 (64.5)	873 (65.1)	1,027 (62.3)	<0.01**
Non-Hispanic Black	96 (6.7)	119 (7.6)	66 (7.2)	84 (6.4)	89 (6.6)	145 (8.8)	NS
Hispanic/Latino	263 (18.3)	299 (19.0)	189 (20.7)	316 (23.9)	299 (22.3)	385 (23.4)	<0.01**
Non-Hispanic Asian	48 (3.3)	48 (3.1)	29 (3.2)	48 (3.6)	52 (3.9)	71 (4.3)	NS
Non-Hispanic Other	30 (2.1)	13 (0.8)	9 (1.0)	21 (1.6)	29 (2.2)	21 (1.3)	NS

** Significant at the 0.5 level
NS = not significant

Table 2. Clinical characteristics of individuals with foodborne illnesses by pathogen, 2023 (N = 1,871)

Pathogen	**Total**	**Incidence per 100,000**	**Hospitalized % (N)**	**Case fatality % (N)**	**Duration of illness (days)***	**Reported symptoms % (N)**		**International travel % (N)**
						Diarrhea	**Fever**	
Total	1,871	51.89	31.3 (585)	1.1 (21)	-	-	-	-
Campylobacter	846	23.46	27.2 (230)	0.6 (5)	8.6 ± 6.0	97.9 (779)	47.0 (356)	17.1 (123)
Salmonella	483	13.39	37.9 (179)	1.0 (5)	9.1 ± 7.5	92.0 (232)	51.6 (232)	23.2 (101)
Shigella	168	4.66	42.9 (72)	1.2 (2)	9.2 ± 6.6	97.5 (158)	58.2 (89)	28.6 (42)
STEC	141	3.91	23.4 (33)	1.4 (2)	8.5 ± 5.4	96.2 (128)	32.8 (41)	29.7 (38)
Yersinia	133	3.69	33.8 (45)	0.8 (1)	40.7 ± 75.8	95.9 (118)	17.4 (20)	4.7 (5)
Vibrio	47	1.30	42.6 (20)	4.3 (2)	11.5 ± 19.0	77.3 (34)	32.6 (14)	20.0 (8)
Listeria	15	0.42	93.3 (14)	26.7 (4)	5.5 ± 0.7	57.1 (8)	93.3 (14)	6.7 (1)
Cyclospora	38	1.05	5.3 (2)	0.0 (0)	17.4 ± 9.0	97.3 (36)	26.5 (9)	33.3 (12)

* Duration of illness shown as mean ± standard deviation.

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