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West Nile Virus and Other Nationally Notifiable Arboviral Diseases — United States, 2024

Kimberly E. Mace, PhD[1]; Daniel Jacobs, MS[2]; Carolyn V. Gould, MD[1]; J. Erin Staples, MD, PhD[1]; Shelby L. Lyons, MPH[1]

Abstract

In the United States, arthropodborne viruses (arboviruses) are primarily transmitted by infected mosquitoes or ticks; rarely, they can be transmitted through blood transfusion or organ transplantation. Whereas a majority of arboviral infections are asymptomatic, symptomatic infections range from mild febrile illness to severe neuroinvasive disease. This report summarizes data for nationally notifiable domestic arboviral diseases with illness onset in 2024. Forty-eight states and the District of Columbia reported 1,955 arboviral disease cases, including 189 (10%) deaths. Although the number of West Nile virus (WNV) disease cases in 2024 was below the 10-year median (2,162), WNV caused most reported arboviral disease cases (1,808; 92%). Powassan virus disease was the second most commonly reported arboviral disease (60; 3%), increasing from a previous high of 49 cases in 2023. A majority of patients with arboviral disease were aged ≥60 years (1,133; 58%), were male (1,223; 63%), and had illness onset during July–September (1,603; 82%). However, La Crosse virus disease occurred almost exclusively among children aged <18 years (35 of 37 cases; median age = 8 years; interquartile interval = 5–10 years). Variations in annual demographic characteristics, disease incidence, distribution, and seasonal temporality of arboviral diseases highlight the importance of quality and timely surveillance to increase awareness of disease risk, facilitate testing, and implement control measures. Clinicians should consider arboviral testing for patients with acute febrile or neurologic illness during periods when mosquitoes and ticks are active. Reducing arboviral disease morbidity and mortality relies on use of personal protective measures (e.g., insect repellent and protective clothing), implementing vector-control activities, and screening blood and organ donors for WNV.

Introduction

Arboviruses are maintained in transmission cycles among arthropods and vertebrate hosts, including humans and other animals (*1*). In the United States, humans typically acquire arboviral infections when they are bitten by an infected mosquito or tick and, although rare, through other routes such as blood transfusion and organ transplantation (*2*). Of the most common nationally notifiable domestic arboviral diseases in the continental United States, five are mosquitoborne (West Nile, La Crosse, Jamestown Canyon, eastern equine encephalitis, and St. Louis encephalitis virus diseases) and one (Powassan virus disease) is tickborne. The majority of arboviral infections are asymptomatic, but disease can range from mild febrile illness to severe, potentially fatal, neuroinvasive disease. Older age, certain chronic medical conditions (e.g., cancer, diabetes, high blood pressure, or kidney disease), and immunosuppression are risk factors for neuroinvasive disease. No prophylactic agents or treatments are available for arboviral diseases; therefore, timely and accurate surveillance is critical to help focus prevention measures (e.g., personal protection against mosquito bites and vector control) to reduce disease morbidity and mortality. This report provides an annual update on domestic arboviral disease case numbers and incidence to increase awareness of the occurrence and characteristics of arboviral diseases in the United States (*3*,*4*).

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CENTERS FOR DISEASE CONTROL AND PREVENTION

Methods

Data Source

State health departments voluntarily report cases of nationally notifiable domestic arboviral diseases to CDC by location of patient residence through ArboNET, the national arbovirus surveillance system, using standard surveillance case definitions that include clinical and laboratory criteria. Confirmed and probable cases are included in this report; cases are further characterized as neuroinvasive (i.e., those with meningitis, encephalitis, acute flaccid paralysis, or other unspecified neurologic manifestation) or nonneuroinvasive (all other cases).

Analysis

Confirmed and probable cases with clinically compatible disease and supporting laboratory results were combined in the analysis. The case features of six domestic arboviral diseases (West Nile, Powassan, La Crosse, Jamestown Canyon, eastern equine encephalitis, and St. Louis encephalitis virus diseases) are described and compared with previous years' data reported to ArboNET to identify trends. Incidence was calculated using U.S. Census Bureau 2024 midyear population estimates as denominators and limited to neuroinvasive disease cases because these cases are more severe and therefore more consistently diagnosed and reported (*1*). A negative binomial regression was chosen for the Powassan case trend analysis to account for overdispersion of the annual count data, with the year variable centered to limit multicollinearity; this analysis was conducted using the SAS proc genmod procedure; all analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC, deemed not research, and conducted consistent with applicable federal law and CDC policy.*

Results

Reported Arboviral Disease Cases

CDC received 1,955 reports of confirmed (594; 30%) and probable (1,361; 70%) arboviral disease cases with illness onset in 2024; 1,485 cases (76%) were neuroinvasive (Table 1). Cases were reported from 647 (21%) of 3,143 U.S. counties and from 48 states and the District of Columbia (DC). WNV accounted for 1,808 (92%) cases, followed by Powassan (60; 3%), La Crosse (37; 2%), Jamestown Canyon (27; 1%), eastern equine encephalitis (19; 1%), St. Louis encephalitis (2; <1%), and unspecified California serogroup viruses† (2; <1%). The specific virus was unknown for two cases with California serogroup virus; these cases were excluded from further description in this report.

WNV Disease

In 2024, a total of 1,808 WNV disease cases were reported; median patient age was 64 years (interquartile interval

* 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

† Unspecified California serogroup virus reports belong to the California serogroup (e.g., La Crosse, Jamestown Canyon, snowshoe hare, and California encephalitis viruses), but the specific virus is unknown or not identified.

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TABLE 1. Number and percentage of confirmed* and probable† cases of nationally notifiable arboviral disease, by virus type and selected patient characteristics§ — United States,¶ 2024

Characteristic	Virus type, no. (%)** of cases					
	West Nile	Powassan	La Crosse	Jamestown Canyon	Eastern equine encephalitis	St. Louis encephalitis
Total, no. (N = 1,953)	**1,808**	**60**	**37**	**27**	**19**	**2**
Age group, yrs						
<18	33 (2)	4 (7)	35 (95)	0 (—)	1 (5)	0 (—)
18–59	720 (40)	10 (17)	1 (3)	7 (26)	7 (37)	2 (100)
≥60	1,055 (58)	46 (77)	1 (3)	20 (74)	11 (58)	0 (—)
Sex						
Female	675 (37)	25 (42)	19 (51)	8 (30)	4 (21)	0 (—)
Male	1,133 (63)	35 (58)	18 (49)	19 (70)	15 (79)	2 (100)
Quarter of illness onset						
Jan–Mar	3 (<0.01)	4 (7)	0 (—)	0 (—)	0 (—)	0 (—)
Apr–Jun	115 (6)	28 (47)	1 (3)	10 (37)	1 (5)	0 (—)
Jul–Sep	1,523 (84)	14 (23)	32 (86)	13 (48)	18 (95)	1 (50)
Oct–Dec	167 (9)	14 (23)	4 (11)	4 (15)	0 (—)	1 (50)
Clinical syndrome						
Nonneuroinvasive	461 (25)	0 (—)	1 (3)	7 (26)	0 (—)	1 (50)
Neuroinvasive††	1,347 (75)	60 (100)	36 (97)	20 (74)	19 (100)	1 (50)
Encephalitis	852 (63)	48 (80)	25 (69)	13 (65)	16 (84)	0 (—)
Meningitis	279 (21)	8 (13)	9 (25)	3 (15)	2 (11)	1 (100)
AFP§§	55 (4)	4 (7)	0 (—)	0 (—)	0 (—)	0 (—)
Unspecified	161 (12)	0 (—)	2 (6)	4 (20)	1 (5)	0 (—)
Outcome						
Hospitalization	1,396 (77)	60 (100)	36 (97)	21 (78)	19 (100)	1 (50)
Death	173 (10)	9 (15)	0 (—)	2 (7)	5 (26)	0 (—)

Abbreviations: AFP = acute flaccid paralysis; CSF = cerebrospinal fluid; IgM = immunoglobulin M.

* A confirmed case meets clinical criteria for arboviral disease and at least one of the following laboratory criteria: 1) isolation of virus from, or demonstration of specific viral antigen or nucleic acid in tissue, blood, CSF, or other body fluid; 2) fourfold or higher change in virus-specific quantitative antibody titers in paired sera; 3) virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen; or 4) virus-specific IgM antibodies in CSF and a negative test result for other IgM antibodies in CSF for arboviruses endemic in the region where exposure occurred.

† A probable case meets clinical criteria for arboviral infection and virus-specific IgM antibodies in CSF or serum but without other testing.

§ Two unspecified California serogroup virus cases were reported but are not included in the table.

¶ United States refers to all U.S. states, territories, and the District of Columbia.

** Percentages might not sum to 100 because of rounding.

†† Percentages of cases of encephalitis, meningitis, AFP, and unspecified neurologic signs or symptoms are percentages of neuroinvasive cases.

§§ Among the 55 West Nile virus disease cases with AFP, 15 (27%) also had encephalitis or meningitis. Among the four Powassan virus disease cases with AFP, all four (100%) also had encephalitis or meningitis.

[IQI] = 51–73 years), and 1,133 (63%) patients were male (Table 1). Three fourths (1,347; 75%) of patients had WNV neuroinvasive disease. A total of 1,396 (77%) patients were hospitalized, including 1,263 (91%) with neuroinvasive disease. Overall, 173 (9.6%) patients with reported WNV disease died, 169 (98%) of whom had neuroinvasive disease (case-fatality rate [CFR] = 13% among patients with neuroinvasive disease). A majority of patients had illness onset during July–September (1,523; 84%). Two neuroinvasive WNV disease deaths were reported in patients who were infected through kidney transplantation from a single deceased organ donor.

WNV disease cases were reported from 591 (19%) of 3,143 counties in 48 states and DC. Texas (363 cases), California (103), and New York (69) accounted for 40% of all U.S. WNV neuroinvasive disease cases. The national incidence of WNV neuroinvasive disease was 0.40 per 100,000 population (Table 2), and incidence was highest in North Dakota (2.76), Nebraska (2.49), and Mississippi (1.43) (Figure). Incidence was higher among males (0.52) than females (0.28) and among adults aged ≥70 years (1.30) than persons in other age groups. Incidence was lowest among children aged <10 years (0.02).

The 1,808 reported WNV disease case count in 2024 is below the 10-year median of 2,162 cases (IQI = 1,132–2,628). The 456 cases reported in Texas are more than double the number reported in Texas in 2023 (163).

Powassan Virus Disease

In 2024, a total of 60 Powassan virus disease cases were reported. The median patient age was 69 years (IQI = 60–75 years), with four patients (7%) aged <18 years, and 35 (58%) patients were male (Table 1). All patients were hospitalized with neuroinvasive disease, and nine died (CFR = 15%). Cases occurred throughout the year, and approximately one half (28; 47%) had illness onset during April–June.

TABLE 2. Number and incidence* of confirmed† and probable§ cases of nationally notifiable arboviral neuroinvasive disease, by virus type and U.S. Census Bureau division and jurisdiction — United States,¶ 2024

U.S. Census Bureau division/Jurisdiction	Virus type, no. (incidence) of cases					
	West Nile	Powassan	La Crosse	Jamestown Canyon	Eastern equine encephalitis	St. Louis encephalitis
United States	**1,347 (0.40)**	**60 (0.02)**	**36 (0.01)**	**20 (0.01)**	**19 (0.01)**	**1 (0)**
New England	32 (0.21)	28 (0.18)	—**	3 (0.02)	13 (0.08)	—
Connecticut	10 (0.27)	6 (0.16)	—	—	—	—
Maine	1 (0.07)	6 (0.43)	—	—	1 (0.07)	—
Massachusetts	16 (0.22)	11 (0.15)	—	—	4 (0.06)	—
New Hampshire	1 (0.07)	3 (0.21)	—	2 (0.14)	5 (0.35)	—
Rhode Island	3 (0.27)	2 (0.18)	—	1 (0.09)	1 (0.09)	—
Vermont	1 (0.15)	—	—	—	2 (0.31)	—
Middle Atlantic	149 (0.35)	6 (0.01)	—	1 (0)	4 (0.01)	—
New Jersey	33 (0.35)	2 (0.02)	—	1 (0.01)	2 (0.02)	—
New York	69 (0.35)	3 (0.02)	—	—	2 (0.01)	—
Pennsylvania	47 (0.36)	1 (0.01)	—	—	—	—
East North Central	128 (0.27)	12 (0.03)	4 (0.01)	14 (0.03)	1 (0)	—
Illinois	56 (0.44)	—	—	—	—	—
Indiana	10 (0.14)	—	—	—	—	—
Michigan	24 (0.24)	—	—	8 (0.08)	—	—
Ohio	12 (0.10)	—	4 (0.03)	—	—	—
Wisconsin	26 (0.44)	12 (0.20)	—	6 (0.10)	1 (0.02)	—
West North Central	142 (0.65)	14 (0.06)	2 (0.01)	2 (0.01)	—	—
Iowa	16 (0.49)	—	—	—	—	—
Kansas	11 (0.37)	—	—	—	—	—
Minnesota	26 (0.45)	14 (0.24)	1 (0.02)	2 (0.03)	—	—
Missouri	12 (0.19)	—	1 (0.02)	—	—	—
Nebraska	50 (2.49)	—	—	—	—	—
North Dakota	22 (2.76)	—	—	—	—	—
South Dakota	5 (0.54)	—	—	—	—	—
South Atlantic	130 (0.19)	—	17 (0.02)	—	1 (0)	—
Delaware	1 (0.10)	—	—	—	—	—
District of Columbia	2 (0.28)	—	—	—	—	—
Florida	15 (0.06)	—	—	—	—	—
Georgia	39 (0.35)	—	—	—	—	—
Maryland	24 (0.38)	—	—	—	—	—
North Carolina	27 (0.24)	—	15 (0.14)	—	1 (0.01)	—
South Carolina	15 (0.27)	—	1 (0.02)	—	—	—
Virginia	5 (0.06)	—	—	—	—	—
West Virginia	2 (0.11)	—	1 (0.06)	—	—	—
East South Central	87 (0.44)	—	12 (0.06)	—	—	—
Alabama	27 (0.52)	—	—	—	—	—
Kentucky	8 (0.17)	—	—	—	—	—
Mississippi	42 (1.43)	—	—	—	—	—
Tennessee	10 (0.14)	—	12 (0.17)	—	—	—
West South Central	450 (1.04)	—	1 (0)	—	—	1 (0)
Arkansas	12 (0.39)	—	—	—	—	—
Louisiana	38 (0.83)	—	—	—	—	—
Oklahoma	37 (0.90)	—	—	—	—	—
Texas	363 (1.16)	—	1 (0)	—	—	1 (0)
Mountain	124 (0.47)	—	—	—	—	—
Arizona	23 (0.30)	—	—	—	—	—
Colorado	40 (0.67)	—	—	—	—	—
Idaho	4 (0.20)	—	—	—	—	—
Montana	3 (0.26)	—	—	—	—	—
Nevada	15 (0.46)	—	—	—	—	—
New Mexico	24 (1.13)	—	—	—	—	—
Utah	14 (0.40)	—	—	—	—	—
Wyoming	1 (0.17)	—	—	—	—	—

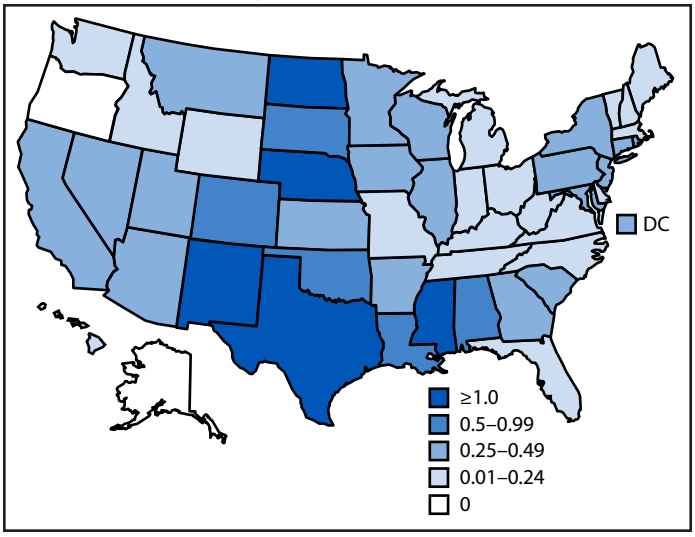
See table footnotes on the next page.

TABLE 2. (*Continued*) Number and incidence* of confirmed† and probable§ cases of nationally notifiable arboviral neuroinvasive disease, by virus type and U.S. Census Bureau division and jurisdiction — United States,¶ 2024

U.S. Census Bureau division/Jurisdiction	Virus type, no. (incidence) of cases					
	West Nile	Powassan	La Crosse	Jamestown Canyon	Eastern equine encephalitis	St. Louis encephalitis
Pacific	105 (0.19)	—	—	—	—	—
Alaska	—	—	—	—	—	—
California	103 (0.26)	—	—	—	—	—
Hawaii	1 (0.07)	—	—	—	—	—
Oregon	—	—	—	—	—	—
Washington	1 (0.01)	—	—	—	—	—

Abbreviations: CSF = cerebrospinal fluid; IgM = immunoglobulin M.
* Cases per 100,000 population, based on July 1, 2024, U.S. Census Bureau population estimates.
† A confirmed case meets clinical criteria for arboviral disease and at least one of the following laboratory criteria: 1) isolation of virus from, or demonstration of specific viral antigen or nucleic acid in tissue, blood, CSF, or other body fluid; 2) fourfold or higher change in virus-specific quantitative antibody titers in paired sera; 3) virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen; or 4) virus-specific IgM antibodies in CSF and a negative test result for other IgM antibodies in CSF for arboviruses endemic in the region where exposure occurred.
§ A probable case meets clinical criteria for arboviral infection and virus-specific IgM antibodies in CSF or serum but without other testing.
¶ United States refers to all U.S. states, territories, and the District of Columbia.
** Dashes indicate no reported cases.

FIGURE. Incidence* of confirmed† and probable§ cases of neuroinvasive West Nile virus disease, by state — United States,¶ 2024



Abbreviations: CSF = cerebrospinal fluid; DC = District of Columbia; IgM = immunoglobulin M.
* Cases per 100,000 population, based on July 1, 2024, U.S. Census Bureau population estimates.
† A confirmed case meets clinical criteria for arboviral disease and at least one of the following laboratory criteria: 1) isolation of virus from, or demonstration of, specific viral antigen or nucleic acid in tissue, blood, CSF, or other body fluid; 2) fourfold or higher change in virus-specific quantitative antibody titers in paired sera; 3) virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen; or 4) virus-specific IgM antibodies in CSF and a negative test result for other IgM antibodies in CSF for arboviruses endemic in the region where exposure occurred.
§ A probable case meets clinical criteria for arboviral infection and virus-specific IgM antibodies in CSF or serum but without other testing.
¶ United States refers to all U.S. states, territories, and DC.

Powassan virus disease cases were reported from 45 counties across 10 states. Nationally, the incidence of neuroinvasive Powassan virus disease was 0.02 per 100,000 population, with the highest incidence in Maine (0.43), Minnesota (0.24), New Hampshire (0.21), and Wisconsin (0.20) (Table 2). From 2023 to 2024, Minnesota and Wisconsin experienced a combined 160% relative increase in cases, from 10 to 26. Nationally, the number of cases reported in 2024 was above the 10-year median of 23 cases (IQI = 21–43), and during the previous 21 years, cases increased with an annual growth rate of 17.5% (95% CI = 13.6–21.6; negative binomial regression; p<0.001).

La Crosse Virus Disease

In 2024, a total of 37 La Crosse virus disease cases were reported; 35 (95%) occurred among children aged <18 years (median age = 8 years; IQI = 5–10 years), and 19 (51%) occurred among females. Overall, 36 (97%) patients were hospitalized, 36 (97%) had neuroinvasive disease, and none died (Table 1). Illness onset occurred during July–September among 32 (86%) patients. Cases were reported from 24 counties in eight states. Overall, 75% of neuroinvasive La Crosse virus disease cases were reported from North Carolina (15) and Tennessee (12), representing a relative increase of 170% from five cases in each state reported in 2023, although the number of cases in 2024 was below the 10-year median (55 cases; IQI = 35–80). The national incidence of neuroinvasive La Crosse virus disease was 0.01 per 100,000 population (0.05 among children aged <18 years) and was highest in Tennessee (0.17), North Carolina (0.14), and West Virginia (0.06) (Table 2).

Jamestown Canyon Virus Disease

In 2024, a total of 27 cases of Jamestown Canyon virus disease was reported; the median patient age was 66 years (IQI = 53–76 years), and 19 (70%) patients were male. Twenty-one (78%) patients were hospitalized, 20 (74%) had neuroinvasive disease, and two (7%) died (CFR = 10% among patients with neuroinvasive disease) (Table 1). Illness onset occurred during July–September for 13 (48%) patients and

April–June for 10 (37%). Cases were reported from 23 counties in six states. The highest numbers of cases were reported from Wisconsin (10), Michigan (eight), and Minnesota (four). The national incidence of neuroinvasive Jamestown Canyon virus disease was 0.01 per 100,000 population, with the highest incidences in New Hampshire (0.14), Wisconsin (0.10), Rhode Island (0.09), and Michigan (0.08) (Table 2). The number of Jamestown Canyon virus disease cases in 2024 was similar to the 10-year median (21 cases; IQI = 12–41).

Eastern Equine Encephalitis Virus Disease

In 2024, a total of 19 cases of eastern equine encephalitis virus disease were reported; the median patient age was 68 years (IQI = 53–78 years), and 15 (79%) patients were male. All patients were hospitalized with neuroinvasive disease, and five died (CFR = 26%) (Table 1). Eighteen (95%) patients had illness onset during July–September. Cases were reported from 12 counties in nine states. The highest numbers of cases were reported by New Hampshire (five) and Massachusetts (four). The national incidence of neuroinvasive eastern equine encephalitis virus disease was 0.01 per 100,000, and rates were highest in New Hampshire (0.35) and Vermont (0.31) (Table 2). The number of reported eastern equine encephalitis disease cases in 2024 was the highest since 2019 and higher than the 10-year median of 6.5 (IQI = 5–8).

St. Louis Encephalitis Virus Disease

Two cases of St. Louis encephalitis virus disease were reported in 2024, both in men aged <60 years. One patient was hospitalized with neuroinvasive disease, and both survived (Table 1). Illness onsets occurred in August and November. One neuroinvasive case was reported from Texas corresponding to an incidence of <0.01 per 100,000 population (Table 2). The number of St. Louis encephalitis virus disease cases was the lowest since 2013 and substantially lower than the 10-year median of 16.5 cases (IQI = 10–21).

Discussion

Domestic arboviruses occur in arthropod and animal hosts throughout the continental United States. Local ecology and climate, especially temperature and moisture, host immunity, and human activities all influence disease occurrence. In 2024, WNV was the most common domestic arbovirus, but the number of reported cases was below the 10-year median. High case counts are often driven by regional outbreaks, as in 2024 when 456 WNV disease cases reported from Texas accounted for 25% of all WNV cases, highlighting geographic heterogeneity in transmission. The numbers of eastern equine encephalitis and Powassan virus disease cases in 2024 were higher than the previous 10-year medians, which is especially concerning because these two arboviral diseases are associated with the highest CFRs among domestic arboviral diseases (26% and 15%, respectively). Eastern equine encephalitis is characterized by periodic surges over time and in certain geographic areas; the number of cases reported in 2024 (19) was the third highest reported since 2003, following 2019 (38) and 2005 (21) (*5–7*). In contrast, the number of Powassan virus disease cases has been increasing by an average of 17.5% annually during the past 21 years. The reasons for this might be related to an actual increase in incidence, improved health care provider awareness, expanded availability of diagnostic testing at commercial and state public health laboratories, or potential expansion of the vector range (*8*).

In the United States, although adults aged ≥60 years are at higher risk for most neuroinvasive arboviral disease and poor outcomes compared with younger persons, who are more likely to have an asymptomatic or mild, febrile illness (*1,9*), La Crosse virus disease occurs more commonly among children. In 2024, La Crosse virus disease accounted for 54% of the 63 neuroinvasive arboviral disease cases reported among children aged <18 years, followed by WNV disease (35%) and Powassan virus disease (6%). Arboviral morbidity among children can be severe, including neuroinvasive disease and death (*10*).

One WNV transplant cluster associated with two neuroinvasive disease deaths was identified in 2024. Although rare, arboviral transmission through solid organ transplantation is often associated with high morbidity and mortality among organ recipients, likely related to their immunosuppression (*2*). Organ donors in the United States, unlike blood donors, were not universally screened for WNV. However, a policy that requires seasonal WNV screening (July 1–October 31) for all potential living and deceased solid organ donors was implemented in June 2026.

Limitations

The findings in this report are subject to at least three limitations. First, cases can be misclassified because inclusion in ArboNET does not require clinical signs and symptoms or diagnostic laboratory test results. Second, ArboNET is a passive surveillance system that relies on patients seeking health care, appropriate testing by clinicians, and reporting of arboviral disease cases; thus, prevalence is likely underestimated. Conservative estimates based on historical ratios and assuming comparable national reporting patterns, population characteristics, and environmental conditions demonstrated that 30–70 nonneuroinvasive disease cases occur for every reported case of WNV neuroinvasive disease (*9*); accordingly, 40,410–94,290 nonneuroinvasive WNV disease cases likely occurred nationally in 2024, although only 461 (0.5%–1% of the estimated total) were reported. Finally, the average annual

Summary

What is already known about this topic?

West Nile virus (WNV) is the leading cause of arthropodborne viral (arboviral) disease, manifesting as acute febrile or neurologic illness in the United States. Several other arboviruses transmitted through bites of infected mosquitoes or ticks also occur in the United States and cause similar illnesses. Transmission through blood transfusion or organ transplantation has been reported.

What is added by this report?

In 2024, arboviral disease cases were reported from 48 states and the District of Columbia. WNV was most common, followed by Powassan virus disease, which increased to a new record high. La Crosse virus disease was the most common arboviral disease among children; the case-fatality rate was highest for eastern equine encephalitis.

What are the implications for public health practice?

Clinicians should consider arboviral testing for patients with fever or neurologic illness, particularly when mosquitoes and ticks are active. Timely surveillance can be used to identify geographic areas at risk for arboviral infection. Reducing arboviral diseases depends on personal protective measures, vector control, and screening blood and organ donors for WNV.

growth rate estimated for the Powassan virus disease trend is limited to the 21-year historical period and is not necessarily a predictor of future trends.

Implications for Public Health Practice

High-quality and timely surveillance is critical to understanding the epidemiology, seasonality, and geographic distribution of domestic arboviruses, which can facilitate clinical recognition, identification of outbreaks, messaging activities to the public and health care providers, and vector-control activities. WNV and other arboviral disease testing should be considered by clinicians for patients with acute febrile or neurologic illness, including recipients of organ transplants or blood transfusions, particularly during times when mosquitoes and ticks are active. Health care providers who order testing for a specific causative agent should take into consideration the timing of illness onset, type and location of exposures, patient age, and underlying health status.

The seasonality of arboviral diseases varies according to the vectors responsible for transmitting them; ticks, which transmit Powassan virus, are active earlier and later during the season compared with mosquitoes that typically have peak activity during July–September. Therefore messaging (e.g., media, newsletters, and education at trailheads or parks) to increase public and health care provider awareness can be tailored based on locally circulating arboviruses and the activity of their vectors.

Approximately 25 years after the detection of WNV in the United States, effective tools for diagnosis, prevention, and treatment are lacking. Consistently high WNV disease incidence each year indicates that further research and development of additional strategies, such as human vaccines and prophylactic or therapeutic monoclonal antibodies for persons at high risk for severe illness, are needed. Development of rapid diagnostic tests can facilitate earlier and more reliable diagnosis, which would also improve patient care, disease surveillance, timely public health messaging, and the ability to conduct clinical trials.

Because no specific treatments (e.g., antiviral medications) are available for domestic arboviral diseases, clinical management is supportive. Likewise, no prophylactic agents (e.g., human vaccines) are available to prevent domestic arboviral diseases; therefore, prevention and control rely on use of personal protective measures (e.g., using insect repellent registered by the Environmental Protection Agency and wearing protective clothing), vector-control activities both at household and community levels (CDC | Ticks | Preventing Tick Bites and CDC | Mosquitoes | Mosquito Control), and WNV blood and organ donor screening to minimize transfusion- and transplant-associated transmission.

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National Arboviral Surveillance System surveillance coordinators in state and local health departments; Surveillance and Epidemiology Team, Arboviral Diseases Branch, CDC.

Corresponding author: Kimberly E. Mace, kmace@cdc.gov.

[1]Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [2]Alaka`ina Foundation, Orlando, Florida.

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Effect of Diagnostic Test Type on Detection of *Salmonella* Infections — Foodborne Diseases Active Surveillance Network, 2004–2024

Reese Tierney, MPH[1]; Robin Pendley Louis, DrPH[1]; David J. Boxrud, MS[1]; Kennedy Houck Lamas, MPH[1]; Kristina M. Angelo, DO[1]; Daniel L. Weller, PhD[1]

Abstract

Salmonella species bacterial infections are a leading cause of enteric illness and can be diagnosed using bacterial culture or culture-independent diagnostic tests (CIDTs). All culture-diagnosed cases are considered culture confirmed. After a positive CIDT, infection can be culture confirmed if reflex culture is attempted and yields an isolate. A culture-unconfirmed infection is a CIDT-diagnosed infection for which reflex culture was not attempted or failed to yield an isolate. Foodborne Diseases Active Surveillance Network data from 2006 through 2023 were analyzed to compare the epidemiologic and clinical characteristics of *Salmonella* infections after stratifying by diagnostic method (culture versus CIDT) and culture confirmation status (culture confirmed versus unconfirmed). To improve the precision and stability of temporal trend estimates, incidence trends during 2004–2024, as opposed to 2006–2023, were evaluated overall, by diagnostic method, and by confirmation status using regression. Although overall incidence remained stable from 2004 through 2024, the incidence of culture-diagnosed and -confirmed infections declined, and the incidence of CIDT-diagnosed and unconfirmed infections increased. Culture- and CIDT-diagnosed *Salmonella* infections were demographically similar but exhibited distinct clinical patterns, with CIDT diagnosis associated with milder and more sporadic illnesses, which suggests that these infections were historically underdiagnosed by culture-based diagnostics. The success of prevention efforts that reduce more severe, traditionally culture-detected *Salmonella* infections might be offset by the expanded detection of milder infections through CIDTs. The increases in detection of milder infections through CIDTs may offset the results of successes in prevention efforts in reduction in severe Salmonella infections. Understanding how diagnostic methods influence observed surveillance trends is therefore critical for evaluating and guiding future prevention efforts.

Introduction

Salmonella species bacterial infections are a leading cause of enteric gastrointestinal disease in the United States and are spread through consumption of or contact with contaminated food or water or contact with infected persons or animals. *Salmonella* infection can be categorized as nontyphoidal *Salmonella* (NTS) or typhoidal *Salmonella* (TS). TS infections include typhoid fever and *Paratyphi* infections. These infections accounted for approximately 1% (1,496 of 107,207) of *Salmonella* infections in the United States during 2004–2024, and approximately 70% of these TS infections were associated with international travel (1,031 of 1,496 during 2004–2024). In contrast, NTS is the second leading cause of domestically acquired bacterial foodborne illness in the United States, causing an estimated 1.3 million illnesses and 12,500 hospitalizations in 2019 (*1*,*2*). One objective of *Healthy People 2030* is to reduce domestically acquired NTS infection to fewer than 11.5 infections per 100,000 population by 2030 (*3*). The incidence of domestically acquired NTS infection in the Foodborne Diseases Active Surveillance Network (FoodNet) was 15.2 infections per 100,000 population in 2024, which might suggest that limited progress has been made toward this goal (*3*).

Historically, *Salmonella* infection, whether NTS or TS, has been diagnosed using culture-based methods. Culture-independent diagnostic tests (CIDTs), which detect a pathogen's genetic material or antigens, have been increasingly used since 2013, are often performed as part of multiplex panels, and can identify enteric infections without requiring pathogen-specific clinical suspicion (*4*). After a CIDT diagnosis, infections can be culture confirmed.* For several enteric pathogens, increasing CIDT use has been associated with higher reported incidence and changes in the characteristics of reported infections (*2*,*5*). Consequently, changes in diagnostic practices can complicate interpretation of illness trends and assessment of progress toward disease reduction goals (*5*,*6*). To assess how evolving diagnostic practices affect *Salmonella* epidemiology, this report describes *Salmonella* infection incidence and characteristics for illnesses reported in the FoodNet catchment area by diagnostic method and confirmation status.

Methods

Data Source

During 2004–2023, the FoodNet catchment area included Connecticut, Georgia, Maryland, Minnesota, New Mexico,

* Reflex culture refers to the practice of attempting to isolate a pathogen through culture after a positive CIDT result. Reflex culture practices vary by laboratory, state, and pathogen. Although positive CIDTs do not require a culture for a diagnosis, reflex culture might be attempted after a positive result. Infections diagnosed by CIDT were considered CIDT diagnosed, regardless of reflex culture results. Culture-diagnosed and reflex-culture–positive CIDT-diagnosed infections were considered culture confirmed.

Oregon, and Tennessee and selected counties in California, Colorado, and New York (i.e., the historic FoodNet catchment area). In 2023, the FoodNet catchment area expanded to include all Colorado counties (i.e., the expanded FoodNet catchment area) (*2*).

FoodNet has conducted active, population-based surveillance for culture-diagnosed infections since 1996 and, since 2012, for CIDT-diagnosed infections caused by eight enteric pathogens, including *Salmonella,* in the FoodNet catchment area† (*2*). After a CIDT diagnosis, infections are considered culture confirmed if reflex culture is attempted and yields an isolate. All culture-diagnosed cases are considered culture confirmed. An unconfirmed infection is an infection for which reflex culture was not attempted or failed to yield an isolate.

For each illness, FoodNet collects demographic, clinical, specimen type, and other data, including whether the illness is outbreak-associated or sporadic, and whether the person reported international travel <30 days before TS infection onset or <7 days before NTS infection onset. To diagnose a *Salmonella* infection, various specimens can be tested, including blood, stool, and urine. Data for all *Salmonella* infections reported to FoodNet during 2004–2024 (NTS and TS) were obtained for use in this report, although slightly different ranges of years were used, depending on the analysis.

Statistical Methods

All data were analyzed in R (version 4.4.1; R Foundation). Sensitivity analyses excluded persons reporting international travel and used data from the expanded FoodNet catchment area. Because these analyses produced similar results, findings from the historic FoodNet catchment area, including travel-associated cases, are included.

The demographic and clinical characteristics of infections reported during 2006–2014 and 2015–2023 were compared after stratification by diagnostic method and confirmation status. These years were selected to reflect the period immediately before and after Food and Drug Administration (FDA) approval of the first CIDT multiplex panel with a *Salmonella* target in 2013 and to allow for equal time periods for comparison before and after CIDT adoption.§ Demographic and clinical characteristics were not available for 2024 at the time of this analysis. For each period, the average annual incidences (number of cases per 100,000 population) were calculated using U.S. Census Bureau intercensal population estimates.¶ Incidence rate ratios (IRRs) with 95% CIs were used to compare incidences across periods and stratum. Counterfactual random forest (CFRF),** a method to quantify differences in odds of a case being diagnosed by CIDT (versus culture) for different demographic patient and clinical illness characteristics, was also conducted†† (*5*,*7*).

Bayesian splines regression§§ was used to model trends in culture-diagnosed and culture-confirmed infections during 2004–2024 and in CIDT-diagnosed and unconfirmed infections during 2011–2024¶¶ (*8*,*9*). All available data from 2004–2024 were used to identify long-term trends and improve estimate precision. This activity was reviewed by CDC, deemed not research, and conducted consistent with applicable federal law and CDC policy.***

Results

During 2004–2024, the overall *Salmonella* infection incidence remained stable. The incidence of culture-diagnosed and culture-confirmed infections decreased, and the incidence of CIDT-diagnosed and unconfirmed infections increased

† FoodNet is a collaboration among CDC, 10 state health departments, the U.S. Department of Agriculture, and FDA.

§ Individual laboratories developed and began using CIDTs with a *Salmonella* target in 2012; these laboratory-developed tests were not FDA approved. The first FDA-approved CIDT with a *Salmonella* target was released in 2013. The number and adoption of FDA-approved CIDTs increased from 2013 onwards. Rapid use began in 2015.

¶ Incidence per 100,000 population was calculated by dividing the number of infections during a given year by the U.S. Census Bureau census or intercensal population estimates for that year using the calculate_average_annual_incidence function in the epi-toolbox-r repository. Unknown responses were included in proportion denominators. Missing values were treated as "not reported" for all analyses. Incidence rate ratios were calculated by dividing, for a given stratum, the incidence rate for 2015–2023 by the incidence rate for 2006–2014.

** CFRF builds an ensemble of decision trees to model the relationship between exposures and outcomes. For each observation, it predicts outcomes under both observed and counterfactual exposure scenarios. These predicted probabilities are then used to estimate ORs by contrasting outcome probabilities across exposure conditions.

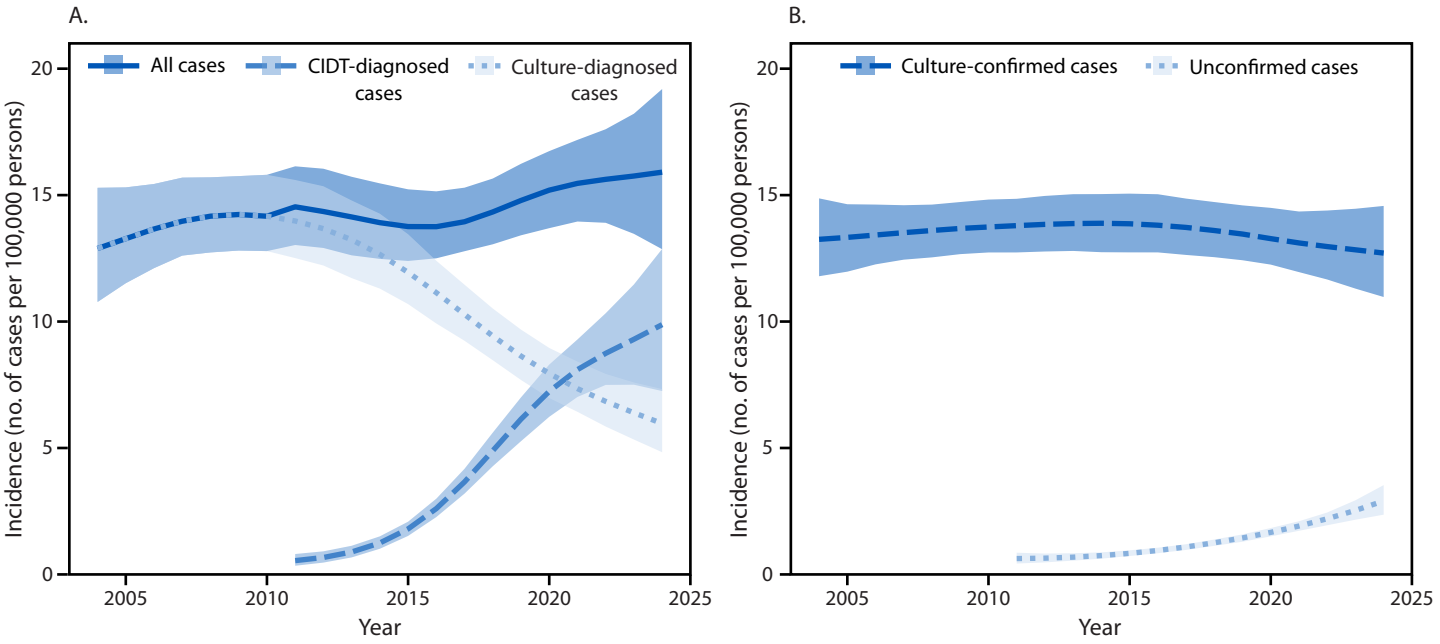
†† Periods were categorized as 2006–2014 (before CIDTs or when laboratory-developed CIDTs were available); 2015–2017 (early FDA-approved CIDTs); 2018–2019 (prepandemic); 2020–2021 (COVID-19 pandemic onset); and 2022–2023 (high CIDT adoption). This categorization captured increasing CIDT use and COVID-19–related reporting disruptions that might have differentially affected health care seeking and reporting across populations and jurisdictions.

§§ In contrast with frequentist statistics, which involve significance testing, in a Bayesian model, true significance testing is not performed, and differences are determined to be substantial or not based on the magnitude of effect. Although CIDT-diagnosed infections were not reported until 2012, data for 2011 were included as baseline years (i.e., structural zeros) because CIDTs were not yet in use during that period.

¶¶ Log incidence rate was modeled as the sum of group effects (i.e., diagnostic method or culture confirmation status), group-specific trends, and state-specific trends. Population was included as an offset. The separate spline terms (basis dimension = 6) allowed trends to vary by group effect and state. Weakly informative priors were specified: exponential (10) on spline SDs, normal (−9, 0.25) on the intercept, normal (0, 0.5) on coefficients, gamma (10, 2) on the shape parameter, and normal (−2, 1) on the zero-inflation parameter.

*** 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. Trend in the estimated incidence* of all *Salmonella* infections, infections diagnosed by culture and culture-independent diagnostic tests (A), and culture-confirmed and unconfirmed *Salmonella* infections (B) — Foodborne Diseases Active Surveillance Network, 2004–2024



Abbreviation: CIDT = culture-independent diagnostic test.

* All culture-diagnosed infections were considered culture confirmed; CIDT-diagnosed infections were considered confirmed if a reflex culture after CIDT diagnosis was performed and a *Salmonella* isolate was obtained. An infection was considered unconfirmed if reflex culture was not attempted or failed to yield an isolate. All available data from 2004–2024, as opposed to 2006–2023, were used to identify long-term trends and improve estimate precision.

(Figure).[†††] The number of infections diagnosed by CIDT exceeded those diagnosed by culture in 2021.[§§§]

During 2006–2014 and 2015–2023, a total of 66,993 infections (incidence = 15.8 infections per 100,000 population) and 73,254 infections (incidence = 16.12) were reported, respectively (Table 1) (Supplementary Table 1). Overall, 66,281 infections (incidence = 15.70) and 44,942 infections (incidence = 9.89) during 2006–2014 and 2015–2023, respectively, were culture diagnosed (IRR = 0.63), whereas 712 infections (incidence = 0.17) and 28,312 infections (incidence = 6.23) were CIDT diagnosed (IRR = 36.65) (Table 1) (Supplementary Table 2). A total of 312 infections (incidence = 0.07) during 2006–2014 and 8,448 infections (incidence = 1.86) during 2015–2023 were not culture confirmed (IRR = 26.57) (Supplementary Table 3). Although the incidence of culture-confirmed infections decreased from 2006–2014 (incidence = 15.70) to 2015–2023 (incidence = 14.30), the magnitude of the decrease was small (IRR = 0.91).

Infections identified using blood specimens (odds ratio [OR] = 0.02) or urine specimens (OR = 0.03), rather than stool specimens, had lower odds of being diagnosed by CIDT than by culture (Table 2). Other indicators of severe infection (i.e., hospitalization or having bloody diarrhea) were also associated with lower odds of CIDT diagnosis, although effect sizes were closer to 1.0. Odds of CIDT diagnosis were lower for outbreak-associated versus sporadic infections (OR = 0.20). Despite statistically significant associations, ORs for demographic characteristics were generally close to 1.0, suggesting minimal demographic differences between CIDT-diagnosed and culture-diagnosed infections.

Discussion

Overall *Salmonella* infection incidence remained stable during 2006–2023; however, substantial shifts in clinical testing practices occurred with increasing use of CIDTs and decreasing reliance on culture-based diagnosis over time. Geographic differences in odds of CIDT diagnosis likely reflect variation in CIDT adoption by laboratories serving different communities (*5,8*).

[†††] In 2004, 2014, and 2024, the estimated incidences per 100,000 population of all *Salmonella* infections were 13.25 (95% credible interval [CrI] = 11.79–14.87), 14.63 (95% CrI = 13.50–15.81), and 15.64 (95% CrI = 13.70–17.67), respectively. In 2004, all *Salmonella* infections were diagnosed using culture-based tests and, thus, were all culture confirmed. In 2014, the estimated incidences per 100,000 population of confirmed and unconfirmed *Salmonella* infections were 13.89 (95% CrI = 12.74–15.04) and 0.75 (95% CrI = 0.62–0.87), respectively. In 2024, the estimated incidences per 100,000 population of confirmed and unconfirmed *Salmonella* infection were 12.70 (95% CrI = 10.97–14.57) and 2.91 (95% CrI = 2.36–3.53), respectively.

[§§§] In 2021, the estimated incidences per 100,000 population of culture and CIDT-diagnosed *Salmonella* infections were 7.34 (95% CrI = 6.43–8.42) and 8.10 (95% CrI = 7.02–9.29), respectively.

TABLE 1. Demographic characteristics of patients with *Salmonella* species infections diagnosed by culture-based tests or culture-independent diagnostic tests — Foodborne Diseases Active Surveillance Network catchment area, 2006–2014 and 2015–2023

	2006–2014				2015–2023				IRR, 2015–2023 vs. 2006–2014 (95% CI)	
	Cx		CIDT†		Cx		CIDT†			
Characteristic	No. (%)	Incidence*	No. (%)	Incidence*	No. (%)	Incidence*	No. (%)	Incidence*	Cx	CIDT†
Total, no.	**66,281**	**15.70**	**712**	**0.17**	**44,942**	**9.89**	**28,312**	**6.23**	**0.63 (0.62–0.64)**	**36.65 (34.02–39.48)**
Age group, yrs										
<1	6,535 (10)	13.54	121 (17)	0.25	3,301 (7)	7.20	2,769 (10)	6.04	0.53 (0.51–0.56)	24.16 (20.14–28.98)
1–4	10,742 (16)	5.51	178 (25)	0.09	5,443 (12)	2.89	4,156 (15)	2.20	0.21 (0.21–0.22)	24.44 (21.04–28.4)
5–17	10,436 (16)	1.59	124 (17)	0.02	5,386 (12)	0.81	3,538 (12)	0.53	0.51 (0.49–0.53)	26.50 (22.16–31.7)
18–59	27,470 (41)	1.24	214 (30)	0.01	19,421 (43)	0.85	12,141 (43)	0.53	0.69 (0.67–0.70)	53.00 (46.3–60.67)
≥60	11,054 (17)	1.59	75 (11)	0.01	11,389 (25)	1.25	5,708 (20)	0.63	0.79 (0.77–0.81)	63.00 (50.17–79.12)
Not reported	44 (<0.1)	—§	1 (<0.1)	—	2 (<0.1)	—	0 (—)	—	—	—
Ethnicity										
Hispanic or Latino	6,246 (9)	13.31	52 (7)	0.11	4,697 (10)	8.10	3,783 (13)	6.53	0.61 (0.59–0.63)	59.36 (45.15–78.05)
Not Hispanic or Latino	45,873 (69)	12.18	529 (74)	0.14	34,916 (78)	8.81	21,672 (77)	5.47	1.38 (1.36–1.40)	39.07 (35.84–42.59)
Not reported	14,161 (21)	—	131 (18)	—	5,329 (12)	—	2,857 (10)	—	—	—
Race										
American Indian or Alaska Native	648 (1)	12.87	1 (0.1)	0.02	450 (1)	7.65	209 (1)	3.55	0.59 (0.53–0.67)	177.50 (24.89–1266.05)
Asian	3,002 (5)	14.04	38 (5)	0.18	1,957 (4)	7.09	1,376 (5)	4.98	0.50 (0.48–0.53)	27.67 (20.04–38.19)
Black or African American	9,116 (14)	13.53	55 (8)	0.08	6,175 (14)	8.13	3,487 (12)	4.59	0.60 (0.58–0.62)	57.38 (43.96–74.89)
Native Hawaiian or Pacific Islander	83 (<1)	20.55	1 (<1)	0.25	94 (<1)	10.90	68 (<1)	7.89	0.53 (0.39–0.71)	31.56 (4.38–227.3)
White	41,932 (63)	13.11	477 (67)	0.15	29,565 (66)	8.93	19,005 (67)	5.74	0.68 (0.67–0.69)	38.27 (34.94–41.91)
Multiple races	648 (1)	6.83	5 (1)	0.05	481 (1)	3.73	446 (2)	3.46	0.55 (0.49–0.61)	69.20 (28.66–167.07)
Other race	1,443 (2)	—	12 (1.7)	—	1,827 (4)	—	1,537 (5)	—	—	—
Not reported	9,409 (14)	—	123 (17)	—	4,393 (10)	—	2,184 (8)	—	—	—
Sex										
Female	34,572 (52)	16.02	352 (49)	0.16	24,244 (54)	10.51	14,804 (52)	6.42	0.66 (0.65–0.67)	40.12 (36.10–44.6)
Male	31,603 (48)	15.21	358 (50)	0.17	20,570 (46)	9.19	13,435 (47)	6.00	0.60 (0.59–0.61)	35.29 (31.78–39.20)
Not reported	106 (<1)	—	2 (<1)	—	128 (<1)	—	73 (<1)	—	—	—

Abbreviations: CIDT = culture-independent diagnostic test; Cx = culture; IRR = incidence rate ratio.

* Incidence per 100,000 population was calculated by dividing the number of infections during a given year by the U.S. Census Bureau census or intercensal population estimates for that year using the calculate_average_annual_incidence function in the epi-toolbox-r repository.

† Includes cases diagnosed by CIDT only (CIDT+ [i.e., no reflex Cx]) or by CIDTs with either a positive reflex Cx (CIDT+/Cx+) or negative reflex Cx (CIDT+/Cx–).

§ Dashes indicate that data were not reported or were otherwise missing from the Foodborne Diseases Active Surveillance Network database. U.S. Census Bureau data used to describe catchment area characteristics do not include a comparable "not reported" category for any of the characteristics of interest.

Although demographic characteristics of culture- and CIDT-diagnosed infections were similar, they differed by severity and signs and symptoms. Mild and sporadic illnesses were more likely to be CIDT diagnosed, whereas severe (e.g., bloodstream) and outbreak-associated illnesses were more often culture diagnosed. This pattern might reflect the common clinical practice of ordering blood cultures for patients with signs and symptoms of sepsis. Overall, these findings indicate that CIDTs might have altered the spectrum of *Salmonella* illnesses detected without fundamentally changing the demographic profile of reported *Salmonella* cases. As a result, CIDTs might detect mild and sporadic illnesses (or infections) that previously would

TABLE 2. Odds that a *Salmonella* species infection was diagnosed by a culture-based test or a culture-independent diagnostic test — Foodborne Diseases Active Surveillance Network, 2006–2023

Characteristic	OR	95% CI	p-value
Clinical characteristics			
Hospitalized*			
No	Ref	—	—
Yes	0.78	(0.75–0.82)	<0.001
Not reported	1.42	(1.30–1.56)	<0.001
Illness type			
Sporadic	Ref	—	—
Outbreak associated†	0.20	(0.17–0.24)	<0.001
Patient status			
Alive	Ref	—	—
Dead§	1.25	(0.95–1.64)	0.11
Not reported	2.20	(2.03–2.38)	<0.001
Specimen type			
Stool or rectal swab specimen	Ref	—	—
Blood	0.02	(0.01–0.03)	<0.001
Urine	0.03	(0.02–0.04)	<0.001
Other	0.89	(0.76–1.04)	0.14
Not reported	1.09	(0.84–1.43)	0.52
Signs and symptoms¶			
Bloody diarrhea			
No	Ref	—	—
Yes	0.84	(0.80–0.89)	<0.001
Not reported	0.71	(0.68–0.75)	<0.001
Any diarrhea			
No	Ref	—	—
Yes	0.64	(0.59–0.69)	<0.001
Not reported	0.92	(0.85–0.99)	0.03
Fever			
No	Ref	—	—
Yes	0.69	(0.66–0.73)	<0.001
Not reported	0.80	(0.76–0.84)	<0.001
Demographic characteristics			
Age group, yrs			
<1	Ref	—	—
1–4	0.89	(0.82–0.96)	0.002
5–17	0.70	(0.64–0.76)	<0.001
18–59	0.62	(0.58–0.66)	<0.001
≥60	0.68	(0.63–0.74)	<0.001
Ethnicity			
Hispanic or Latino	1.09	(1.02–1.17)	0.01
Not Hispanic	Ref	—	—
Not reported	1.18	(1.12–1.25)	<0.001
Race			
American Indian or Alaska Native	0.90	(0.71–1.14)	0.38
Asian	1.38	(1.26–1.51)	<0.001
Black or African American	1.08	(1.01–1.15)	0.02
White	Ref	—	—
Multiple races	1.36	(1.14–1.62)	0.001
Other race	1.15	(1.03–1.28)	0.01
Not reported	1.39	(1.31–1.48)	<0.001
Sex			
Female	Ref	—	—
Male	0.95	(0.91–1.00)	0.03
Urbanicity**			
Large metropolitan	Ref	—	—
Large metropolitan fringe (i.e., suburban)	1.36	(1.28–1.44)	<0.001
Medium metropolitan	1.01	(0.93–1.08)	0.89
Small metropolitan	1.02	(0.93–1.10)	0.72
Micropolitan	1.12	(1.04–1.21)	0.003
Noncore (i.e., rural)	1.24	(1.14–1.36)	<0.001
Season			
Summer	Ref	—	—
Fall	1.03	(0.98–1.08)	0.30
Spring	1.02	(0.96–1.09)	0.45
Winter	1.05	(0.99–1.12)	0.11
Site††			
California	1.66	(1.55–1.78)	<0.001
Colorado	1.08	(0.98–1.18)	0.13
Connecticut	0.65	(0.58–0.72)	<0.001
Georgia	1.31	(1.25–1.37)	<0.001
Maryland	1.01	(0.95–1.08)	0.75
Minnesota	0.87	(0.81–0.93)	<0.001
New Mexico	0.62	(0.55–0.70)	<0.001
New York	0.82	(0.74–0.90)	<0.001
Oregon	1.00	(0.91–1.10)	0.98
Tennessee	1.75	(1.66–1.85)	<0.001
Travel status			
Domestically acquired	Ref	—	—
Travel associated§§	1.15	(1.07–1.24)	<0.001
Not reported	1.26	(1.20–1.32)	<0.001
Years			
2006–2014 (before CIDTs and laboratory-developed CIDTs)	Ref	—	—
2015–2017 (early FDA-approved CIDT)	8.43	(7.72–9.20)	<0.001
2018–2019 (prepandemic)	13.27	(12.17–14.48)	<0.001
2020–2021 (COVID-19 pandemic onset)	17.29	(15.85–18.87)	<0.001
2022–2023 (high CIDT adoption)	22.85	(21.02–24.84)	<0.001

Abbreviations: CIDT = culture-independent diagnostic test; FDA = Food and Drug Administration; OR = odds ratio; Ref = referent group.

* Defined as admission to a hospital inpatient unit or an observation stay of >24 hours ≤7 days before or after specimen collection or determined to be related to the infection if beyond this time frame.

† Defined as two or more cases of similar illness associated with a common exposure; some sites also stipulate that illnesses be from one or more households.

§ Attributed to infection when death occurred during hospitalization or ≤7 days after specimen collection from nonhospitalized patients.

¶ Data on signs and symptoms were collected beginning in 2011.

** Urbanicity was determined using the National Center for Health Statistics rural-urban classification scheme for the patient's county of residence.

†† Site variables were dummy variables with values of yes (the infection occurred in a resident of the given state) or no (the infection did not occur in a resident of the given state).

§§ If the patient did not report international travel or had an unknown travel history, the illness was considered to have been domestically acquired. History of international travel was defined as travel ≤7 days before onset of nontyphoidal infections and ≤30 days before onset of typhoidal infections.

Summary

What is already known about this topic?

Despite increasing use of culture-independent diagnostic tests (CIDTs), the impact of these tests on *Salmonella* epidemiology has not been evaluated.

What is added by this report?

Overall *Salmonella* incidence in the Foodborne Diseases Active Surveillance Network catchment area remained stable during 2004–2024, but diagnostic patterns shifted substantially. The incidence of culture-diagnosed infections declined as CIDT-diagnosed infection incidence increased. Mild and sporadic infections were more likely than were severe and outbreak-associated infections to be diagnosed by CIDTs.

What are the implications for public health practice?

Increasing CIDT use allows for improved detection of mild and sporadic infections but might obscure decreases in disease incidence from successful prevention efforts. Surveillance systems and prevention strategies should account for evolving diagnostic practices while maintaining efforts to recover isolates for public health action.

have remained undiagnosed (*4*), increases in CIDT-diagnosed infections might mask reductions in illnesses resulting from successful prevention and control efforts. Diagnostic methods should be accounted for in data analyses, for example, through stratification in epidemiologic investigations and inclusion as a covariate in models.

The slower decline in culture-confirmed (versus culture-diagnosed) infections might suggest reflex culture rates are not decreasing at the same rate CIDT use is increasing, although other factors could contribute to this pattern. For example, *Salmonella* is relatively easy to culture, which might facilitate recovery of isolates after CIDT diagnosis. Maintaining high reflex culture rates after CIDT-diagnosed *Salmonella* infections remains important, because isolates are required for serotyping, whole-genome sequencing (WGS), and antimicrobial susceptibility testing. WGS, in turn, is critical for outbreak detection, source attribution, and other public health surveillance activities.

Limitations

The findings in this report are subject to at least three limitations. First, because FoodNet surveillance includes laboratory-diagnosed infections, changes in care-seeking behaviors or testing practices over time can influence observed trends in infection incidence. Second, infections detected by CIDT were classified as CIDT-positive regardless of reflex culture results, potentially misclassifying infections because of false-positive CIDT results, although false-positive CIDT results are uncommon for *Salmonella* (*10*). Finally, because of the number of unserotyped infections, NTS and TS were not considered separately; instead, a sensitivity analysis excluding travel-associated infections was performed because 70% (1,031 of 1,496 cases) of TS infections compared with 8% (7,935 of 105,711) of NTS infections were travel associated during 2004–2024. Results from the sensitivity analysis were comparable to the primary analysis, suggesting inclusion or exclusion of travel-associated cases, including most TS cases, did not alter the conclusions.

Implications for Public Health Practice

As CIDT use increases, trends in reported *Salmonella* infection incidence should be interpreted in the context of changing diagnostic practices, particularly when comparing trends across time or populations. The increasing use of CIDTs allows for improved detection of mild and sporadic infections, which helps to optimize clinical detection and treatment. However, increasing detection of milder illnesses through CIDTs might obscure declines in more severe infections resulting from successful *Salmonella* infection prevention and control efforts. Performing reflex cultures with CIDT would improve availability of isolates for serotyping, WGS, and antimicrobial susceptibility testing. Continued surveillance, coupled with sustained efforts to recover isolates from CIDT-positive specimens, is important for maintaining effective foodborne disease prevention and response activities. Understanding how evolving diagnostic practices influence observed epidemiologic patterns can improve assessment of progress toward national *Salmonella* reduction goals and help guide prevention strategies.

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Jessica Bitting, Laura Cooley, Carey Lau, Emily Schmitt Matzen, Hazel Shah, Allison Taylor Walker, CDC.

Corresponding author: Daniel L. Weller, dweller@cdc.gov.

[1]Division of Foodborne, Waterborne and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC.

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