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Reported Incidence of Infections Caused by Pathogens Transmitted Commonly Through Food: Impact of Increased Use of Culture-Independent Diagnostic Tests — Foodborne Diseases Active Surveillance Network, 1996–2023

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Abstract

Reducing foodborne disease incidence is a public health priority. This report summarizes preliminary 2023 Foodborne Diseases Active Surveillance Network (FoodNet) data and highlights efforts to increase the representativeness of FoodNet. During 2023, incidences of domestically acquired campylobacteriosis, Shiga toxin-producing *Escherichia coli* infection, yersiniosis, vibriosis, and cyclosporiasis increased, whereas those of listeriosis, salmonellosis, and shigellosis remained stable compared with incidences during 2016–2018, the baseline used for tracking progress towards federal disease reduction goals. During 2023, the incidence and percentage of infections diagnosed by culture-independent diagnostic tests (CIDTs) reported to FoodNet continued to increase, and the percentage of cases that yielded an isolate decreased, affecting observed trends in incidence. Because CIDTs allow for diagnosis of infections that previously would have gone undetected, lack of progress toward disease reduction goals might reflect changing diagnostic practices rather than an actual increase in incidence. Continued surveillance is needed to monitor the impact of changing diagnostic practices on disease trends, and targeted prevention efforts are needed to meet disease reduction goals. During 2023, FoodNet expanded its catchment area for the first time since 2004. This expansion improved the representativeness of the FoodNet catchment area, the ability of FoodNet to monitor trends in disease incidence, and the generalizability of FoodNet data.

Introduction

Reducing the incidence of foodborne and enteric diseases is a public health priority. The Healthy People 2030 (HP2030) initiative established disease reduction goals for *Campylobacter, Listeria*, *Salmonella,* and Shiga toxin-producing *Escherichia coli* (STEC) infections (*1*). To evaluate progress toward HP2030 goals, CDC's Foodborne Diseases Active Surveillance Network (FoodNet) monitors infections caused by eight pathogens transmitted commonly through food. This report summarizes preliminary 2023 surveillance data and describes changes in incidence compared with average annual incidence during 2016–2018, the reference period used by HP2030 (*1*).

Methods

Data Source

FoodNet conducts active, population-based surveillance for laboratory-diagnosed *Campylobacter, Cyclospora, Listeria, Salmonella, Shigella,* STEC, *Vibrio,* and *Yersinia* infections and pediatric hemolytic uremic syndrome (HUS) at 10 U.S. sites;* HUS is monitored because it can be a complication of

* FoodNet is a collaboration among CDC, 10 state health departments, the U.S. Department of Agriculture's Food Safety and Inspection Service, and the Food and Drug Administration. The historic catchment area includes sites under surveillance since 2004, including Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and counties in California (three), Colorado (seven), and New York (34). The expanded catchment area includes these sites and 57 Colorado counties not in the historic catchment area (i.e., the rest of Colorado).

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STEC infection. FoodNet's catchment area expanded during 2023 to include all of Colorado, and now represents 16% of the U.S. population (53.6 million persons); in 2023, the historic catchment area represented 15% of the U.S. population (51.0 million persons). Compared with the historic catchment area, the expansion increased representation for specific populations, including Hispanic or Latino ([Hispanic]; 8% increase), American Indian or Alaska Native (AI/AN; 8% increase), and Native Hawaiian or Pacific Islander (NH/PI; 6% increase) persons (FoodNet collects race and ethnicity as separate variables) as well as persons living in rural counties (10% increase).

Laboratory Testing and Data Collection

Bacterial infections were diagnosed by culture or culture-independent diagnostic tests (CIDTs). Cyclosporiasis was diagnosed by polymerase chain reaction or microscopy. Pediatric HUS surveillance is conducted through a network of nephrologists and infection preventionists and by hospital discharge data review.[†] This report includes 2022 data on pediatric HUS cases, the most recent year for which data are available. This activity was reviewed by CDC, deemed not research, and conducted in accordance with applicable federal law and CDC policy.[§]

[†] FoodNet reviews hospital discharge data for pediatric HUS cases to validate surveillance reports and identify additional cases using *International Classification of Diseases, Tenth Revision* and *International Classification of Diseases, Eleventh Revision* codes.

[§] 45 C.F.R. part 46.102(l)(2), 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.

Statistical Methods

Bayesian negative binomial models were implemented to estimate changes in incidence in the historic catchment area during 2023 compared with average annual incidence during 2016–2018 (overall, and for domestically acquired infections), using R statistical software (version 2.14.0; R Foundation).[¶],[**] Incidence in 2023 was considered substantially different[††] from that during 2016–2018 if the 95% credible interval (CrI) for the incidence rate ratio (IRR) did not include 1.0. Cross-tabulations by demographic and other characteristics were also performed.[§§]

Results

Incidence in 2023 Compared with Average Annual Incidence During 2016–2018

During 2023, FoodNet identified 29,607 infections, 7,234 hospitalizations, and 177 deaths overall (including

[¶] Incidence (cases per 100,000 persons) was calculated by dividing number of infections during 2023 by 2022 U.S. Census Bureau population estimates. Changes in incidence for the historic catchment area were quantified as described previously (https://www.medrxiv.org/content/10.1101/2022.09.14.22279742v1). Because only 1 year of expanded catchment area data are available, incidence changes could not be quantified for the expanded catchment area.

[**] If the ill person did not report international travel or had an unknown travel history, the illness was considered to have been domestically acquired. A history of international travel was defined as travel ≤30 days before listeriosis and *S.* Typhi and *S.* Paratyphi infections onset, ≤14 days before cyclosporiasis onset, and ≤7 days before onset for other infections.

[††] In contrast to frequentist statistics, which use significance testing, in a Bayesian model, true significance testing is not done, and differences are described as substantial.

[§§] Unknown responses were included in proportion denominators.

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domestically acquired and travel-associated infections) in the historic catchment area (Table 1) (Table 2), compared with 31,492 infections, 7,588 hospitalizations, and 184 deaths in the expanded catchment area¶¶ (Supplementary Table; https://stacks.cdc.gov/view/cdc/157822). In both the historic and expanded catchment areas, 15% of cases were associated with international travel. Overall, and for domestically acquired infections only, incidence of campylobacteriosis was highest, followed by salmonellosis and STEC infection. In the historic catchment area during 2023, incidences of domestically acquired campylobacteriosis, cyclosporiasis, STEC infection, vibriosis, and yersiniosis increased compared with those during 2016–2018, whereas listeriosis, salmonellosis, and shigellosis incidences remained stable.

¶¶ Incidence was similar in the historic and expanded catchment areas during 2023 with the exception of a higher cyclosporiasis incidence and a higher percentage of outbreak-associated cases in the expanded catchment area because of a cyclosporiasis outbreak that affected the newly enrolled Colorado counties. https://cdphe.colorado.gov/press-release/cdphe-investigating-cyclospora-outbreak-on-western-slope

TABLE 1. Demographic characteristics of persons with laboratory-diagnosed bacterial and parasitic infections during 2023* in the historic† and expanded§ catchments compared with the overall population of each catchment — Foodborne Diseases Active Surveillance Network, United States, 2023

Characteristic	Historic catchment, no. (%)		Expanded catchment, no. (%)		% Increase¶	
	Cases	Catchment	Cases	Catchment	Cases	Catchment
Total	**29,607**	**51,000,988**	**31,492**	**53,588,559**	**6.4**	**5.1**
Age group, yrs						
≤4	3,534 (11.9)	2,776,555 (5.4)	3,733 (11.9)	2,914,934 (5.4)	5.6	5.0
5–17	2,611 (8.8)	8,123,969 (15.9)	2,780 (8.8)	8,533,731 (15.9)	6.5	5.0
18–59	14,806 (50.0)	28,111,004 (55.1)	15,738 (50.0)	29,538,011 (55.1)	6.3	5.1
≥60	8,656 (29.2)	11,989,460 (23.5)	9,241 (29.3)	12,601,883 (23.5)	6.8	5.1
Not reported	0 (—)**	—**	0 (—)**	—**	—**	—**
Sex						
Female	14,577 (49.2)	25,810,919 (50.6)	15,565 (49.4)	27,076,136 (50.5)	6.8	4.9
Male	14,966 (50.6)	25,190,069 (49.4)	15,863 (50.4)	26,512,423 (49.5)	6.0	5.2
Not reported	64 (0.2)	—**	64 (0.2)	—**	—**	—**
Ethnicity††						
Hispanic or Latino	4,041 (13.6)	6,786,543 (13.3)	4,428 (14.1)	7,348,445 (13.7)	9.6	8.3
Not Hispanic or Latino	21,575 (72.9)	44,214,445 (86.7)	23,011 (73.1)	46,240,114 (86.3)	6.7	4.6
Not reported	3,991 (13.5)	—**	4,053 (12.9)	—**	1.6	—**
Race						
AI/AN	254 (0.9)	676,635 (1.3)	263 (0.8)	728,099 (1.4)	3.5	7.6
Asian	1,562 (5.3)	3,263,553 (6.4)	1,574 (5.0)	3,317,521 (6.2)	0.8	1.7
Black or African American	3,430 (11.6)	8,743,160 (17.1)	3,471 (11.0)	8,825,882 (16.5)	1.2	0.9
NH/PI	54 (0.2)	100,062 (0.2)	60 (0.2)	106,048 (0.2)	11.1	6.0
White	19,599 (66.2)	36,674,840 (71.9)	21,147 (67.2)	38,980,732 (72.7)	7.9	6.3
Other	1,895 (6.4)	—**	2,024 (6.4)	—**	6.8	—**
Multiple races	413 (1.4)	1,542,738 (3.0)	452 (1.4)	1,630,277 (3.0)	9.4	5.7
Not reported	2,400 (8.1)	—**	2,501 (7.9)	—**	4.2	—**
Urbanicity§§						
Urban	24,565 (83.0)	43,609,552 (85.5)	25,740 (81.7)	45,481,094 (84.9)	4.8	4.3
Rural	5,041 (17.0)	7,391,436 (14.5)	5,751 (18.3)	8,107,465 (15.1)	14.1	9.7

Abbreviations: AI/AN = American Indian or Alaska Native; FoodNet = Foodborne Diseases Active Surveillance Network; NH/PI = Native Hawaiian or Pacific Islander; RUCC = rural-urban continuum code.

* Case data for 2023 are preliminary.

† When FoodNet was founded in 1996, the catchment included Minnesota and Oregon and counties in California (two), Connecticut (two), and Georgia (eight). The catchment expanded consistently during 1996–2004 and remained stable during 2004–2022. The historic catchment includes sites under surveillance since 2004, including Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and counties in California (three), Colorado (seven), and New York (34).

§ In 2023, the remaining 57 Colorado counties were enrolled in the FoodNet catchment. The expanded catchment includes those sites that were part of the historic catchment and the remaining 57 Colorado counties. Because yersiniosis is not a notifiable disease in Colorado, FoodNet only collected data on yersiniosis cases in the seven Colorado counties included in the historic catchment. Therefore, yersiniosis data for the historic and expanded catchments will be the same.

¶ Percent increase among persons with the given demographic characteristic in the expanded catchment compared with the historic catchment using the equation (No. in expanded – No. in historic) / (No. in historic) × 100.

** Dashes indicate that the given data point was unknown, not reported, or otherwise missing from the FoodNet data. The U.S. Census Bureau data used to describe catchment characteristics do not include a comparable "not reported" category for any of the characteristics of interest.

†† FoodNet's data collection mechanism includes separate questions about ethnic and racial identity. As a result, persons could identify as any combination of ethnicity and race.

§§ Urbanicity was determined using RUCC (https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/) for the county of residence. During 2020, U.S. Census Bureau data were generated for Connecticut planning regions instead of Connecticut counties; as a result, the 2023 RUCC estimates were calculated for Connecticut planning regions but not Connecticut counties. Because FoodNet collected county of residence (as opposed to planning region of residence) for Connecticut cases, the catchment population and all cases from all sites except Connecticut were stratified into urban and rural using 2023 RUCC data. Connecticut cases were classified as urban or rural using 2013 RUCC data; 2013 is the most recent year for which RUCC data are available for Connecticut counties.

TABLE 2. Number of laboratory-diagnosed infections, hospitalizations, deaths, outbreak-associated cases, and crude incidence in the historic* catchment area during 2023† compared with 2016–2018 average annual incidence and Healthy People 2030 incidence targets,§ by pathogen overall and for domestically acquired infections only — Foodborne Diseases Active Surveillance Network, United States, 2016–2018 and 2023

Pathogen	Infections, no.¶	No. (%)			Crude average incidence,¶¶ 2016–2018	2023 incidence		IRR (95% CrI)†††	HP2030 incidence target§§§
		Hospitalizations**	Deaths††	Outbreak-associated§§		Crude***	Estimated (95% CrI)†††		
All cases (including international travel–associated)¶¶¶									
Bacteria									
Campylobacter	11,926	2,482 (20.8)	49 (0.4)	30 (0.3)	18.2	23.4	21.52 (20.34–22.75)	1.19 (1.11–1.26)	NA
Salmonella††††	8,454	2,456 (29.1)	55 (0.7)	644 (7.6)	16.9	16.6	15.79 (14.89–16.75)	0.97 (0.91–1.04)	NA
S. Enteritidis	1,597	460 (28.8)	12 (0.8)	178 (11.1)	2.6	3.1	2.72 (2.47–3.00)	1.04 (0.93–1.16)	NA
S. Newport	566	179 (31.6)	0 (—)§§§§	23 (4.1)	1.6	1.1	1.26 (1.02–1.64)	0.80 (0.62–1.07)	NA
S. Typhimurium	541	154 (28.5)	1 (0.2)	77 (14.2)	1.4	1.1	1.21 (1.09–1.35)	0.84 (0.75–0.94)	NA
S. Javiana	324	114 (35.2)	4 (1.2)	10 (3.1)	1.2	0.6	0.73 (0.58–0.97)	0.59 (0.44–0.81)	NA
S. I 4,[5],12:i:-	279	79 (28.3)	3 (1.1)	36 (12.9)	0.9	0.5	0.56 (0.47–0.68)	0.65 (0.54–0.81)	NA
Other serotypes	2,850	920 (32.3)	22 (0.8)	277 (9.7)	5.9	5.5	5.43 (5.10–5.79)	0.92 (0.85–0.99)	NA
Not serotyped	2,297	550 (23.9)	13 (0.6)	43 (1.9)	2.6	4.6	4.56 (4.97–5.29)	1.74 (1.44–2.08)	NA
STEC§§§§	3,351	685 (20.4)	14 (0.4)	108 (3.2)	4.7	6.6	6.29 (5.62–7.07)	1.33 (1.16–1.52)	NA
non-O157¶¶¶¶	1,112	183 (16.5)	3 (0.3)	42 (3.8)	2.1	2.2	2.11 (1.83–2.46)	1.03 (0.87–1.23)	NA
O157	298	114 (38.3)	3 (1.0)	51 (17.1)	0.8	0.6	0.61 (0.53–0.69)	0.72 (0.62–0.82)	NA
Not serogrouped	1,941	388 (20.0)	8 (0.4)	15 (0.8)	2.1	3.8	4.03 (3.11–5.60)	1.93 (1.42–2.83)	NA
Shigella	3,186	969 (30.4)	9 (0.3)	124 (3.9)	4.8	6.2	5.44 (4.49–6.69)	1.13 (0.91–1.40)	NA
Yersinia	1,437	325 (22.6)	9 (0.6)	0 (—)§§§§	0.8	2.8	2.59 (2.28–2.97)	3.43 (2.94–4.06)	NA
Vibrio	567	118 (20.8)	5 (0.9)	10 (1.8)	0.7	1.1	1.15 (1.01–1.31)	1.69 (1.47–1.94)	NA
Listeria	163	159 (97.5)	36 (22.1)	5 (3.1)	0.3	0.3	0.30 (0.26–0.34)	1.13 (0.98–1.31)	NA
Parasite									
Cyclospora	523	40 (7.6)	0 (—)§§§§	40 (7.6)	0.3	1.0	1.56 (1.00–2.97)	4.75 (2.76–9.50)	NA
Total	**29,607**	**7,234 (24.4)**	**177 (0.6)**	**961(3.2)**	—§§§§	—§§§§	—§§§§	—§§§§	—§§§§
Domestically acquired cases only†††††									
Bacteria									
Campylobacter	10,516	2,368 (22.5)	48 (0.5)	30 (0.3)	15.8	20.6	19.32 (18.30–20.41)	1.22 (1.15–1.30)	10.9
Salmonella	7,237	2,202 (30.4)	53 (0.7)	621 (8.6)	14.8	14.2	13.92 (13.10–14.81)	0.94 (0.87–1.01)	11.5
S. Enteritidis	1,238	398 (32.1)	10 (0.8)	167 (13.5)	2.1	2.4	2.13 (1.92–2.38)	1.01 (0.89–1.14)	NA
S. Newport	523	170 (32.5)	0 (—)§§§§	23 (4.4)	1.5	1.0	1.17 (0.94–1.55)	0.77 (0.58–1.06)	NA
S. Typhimurium	505	150 (29.7)	1 (0.2)	76 (15.0)	1.4	1.0	1.15 (1.03–1.29)	0.84 (0.74–0.95)	NA
S. Javiana	303	108 (35.6)	4 (1.3)	4 (1.3)	1.2	0.6	0.70 (0.55–0.95)	0.58 (0.43–0.81)	NA
S. I 4,[5],12:i:-	240	72 (30.0)	3 (1.3)	36 (15.0)	0.8	0.5	0.51 (0.42–0.62)	0.64 (0.52–0.80)	NA
Other serotypes	2,436	789 (32.4)	22 (0.9)	273 (11.2)	4.8	4.7	4.80 (4.49–5.15)	0.90 (0.83–0.98)	NA
Not serotyped	1,992	515 (25.9)	13 (0.7)	42 (2.1)	2.4	4.0	4.04 (3.51–4.71)	1.67 (1.38–2.01)	NA
STEC	2,703	617 (22.8)	14 (0.5)	103 (3.8)	4.1	5.3	5.15 (4.63–5.75)	1.25 (1.10–1.42)	3.7
non-O157§§§§§	882	160 (18.1)	3 (0.3)	39 (4.4)	1.7	1.7	1.70 (1.47–1.98)	1.00 (0.85–1.19)	NA
O157	276	111 (40.2)	3 (1.1)	50 (18.1)	0.8	0.5	0.57 (0.50–0.65)	0.71 (0.61–0.81)	NA
Not serogrouped	1,545	346 (22.4)	8 (0.5)	14 (0.9)	1.8	3.0	3.19 (2.52–4.26)	1.79 (1.36–2.48)	NA
Shigella	2,370	886 (37.4)	8 (0.3)	123 (5.2)	4.1	4.6	4.21 (3.42–5.26)	1.02 (0.81–1.29)	NA
Yersinia	1,376	319 (23.2)	9 (0.7)	0 (—)§§§§	0.7	2.7	2.49 (2.18–2.85)	3.47 (2.97–4.08)	NA
Vibrio	501	108 (21.6)	5 (1.0)	10 (2.0)	0.6	1.0	1.02 (0.90–1.16)	1.64 (1.43–1.90)	NA
Listeria§§§§§	160	156 (97.5)	36 (22.5)	5 (3.1)	0.26	0.31	0.29 (0.26–0.34)	1.13 (0.98–1.32)	0.22
Parasite									
Cyclospora	367	34 (9.3)	0 (—)§§§§	39 (10.6)	0.3	0.7	1.25 (0.73–2.87)	5.06 (2.65–12.43)	NA
Total	**25,230**	**6,690 (26.5)**	**173 (0.7)**	**931 (3.7)**	—§§§§	—§§§§	—§§§§	—§§§§	—§§§§

Abbreviations: CIDT = culture-independent diagnostic test; CrI = credible interval; FoodNet = Foodborne Diseases Active Surveillance Network; HP2030 = Healthy People 2030; IRR = incidence rate ratio; NA = not applicable; STEC = Shiga toxin-producing *Escherichia coli*.

* When FoodNet was founded in 1996, the catchment included Minnesota and Oregon and counties in California (two) Connecticut (two), and Georgia (eight). The catchment expanded consistently during 1996–2004; it remained stable during 2004–2022. The historic catchment includes sites under surveillance since 2004, including Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and counties in California (three), Colorado (seven), and New York (34). To facilitate comparability with past FoodNet reports, data for the historic catchment are presented in-text.

† Case data for 2023 are preliminary.

§ HP2030 is a 10-year plan for addressing critical public health priorities and challenges. U.S. Department of Health and Human Services releases priority objectives as part of HP2030, including incidence targets for *Campylobacter*, *Salmonella*, STEC, and *Listeria* infections, to be met by 2030. https://health.gov/healthypeople/objectives-and-data/browse-objectives/foodborne-illness

¶ Bacterial infections were diagnosed using culture or culture-independent diagnostic tests. *Cyclospora* infections were diagnosed using microscopy or polymerase chain reaction.

** Admission to an 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. The average percentage of infections resulting in hospitalizations during 2016–2018, by pathogen, were *Campylobacter* (20%), *Salmonella* (27%), STEC (22%), *Shigella* (24%), *Yersinia* (26%), *Vibrio* (30%), *Listeria* (96%), *Cyclospora* (6%), and overall (24%). Infections with unknown hospitalization status (6% of infections during 2023 and 4% during 2016–2018) were included in the denominator only.

TABLE 2. (*Continued*) Number of laboratory-diagnosed infections, hospitalizations, deaths, outbreak-associated cases, and crude incidence in the historic* catchment area during 2023† compared with 2016–2018 average annual incidence and Healthy People 2030 incidence targets,§ by pathogen overall and for domestically acquired infections only — Foodborne Diseases Active Surveillance Network, United States, 2016–2018 and 2023

†† Attributed to infection when death occurred during hospitalization or ≤7 days after specimen collection from nonhospitalized patients. The average percentage of infections resulting in death during 2016–2018 were, by pathogen, *Campylobacter* (0.4%), *Salmonella* (0.4%), STEC (0.4%), *Shigella* (0.1%), *Yersinia* (1.2%), *Vibrio* (2.1%), *Listeria* (18.6%), *Cyclospora* (0.2%), and overall (0.5%). Infections with unknown death status (8% of infections during 2023 and 3% during 2016–2018) were included in the denominator only.

§§ Generally defined as two or more cases of similar illness associated with a common exposure; some sites also stipulate illnesses be from one or more households. The average percentage of outbreak-associated infections during 2016–2018 were, by pathogen, *Campylobacter* (<1%), *Salmonella* (7%), STEC (4%), *Shigella* (5%), *Yersinia* (<1%), *Vibrio* (4%), *Listeria* (5%), *Cyclospora* (24%), and overall (4%).

¶¶ Cases per 100,000 persons.

*** Crude incidence is unadjusted and is calculated as cases of infection per 100,000 persons.

††† A Bayesian, negative binomial model with penalized thin plate splines adjusting for state-specific trends was used to quantify adjusted incidence in 2023 and the IRR in 2023 compared with average incidence during 2016–2018. Incidence during 2023 was described as increased or decreased compared with 2016–2018 if the 95% CrI for the IRR did not include 1. A 95% CrI is analogous to a 95% CI in frequentist statistics and can be interpreted similarly, meaning a 95% probability of the true IRR for incidence in 2023 compared with average annual incidence during 2016–2018 is within the 95% CrI. https://www.medrxiv.org/content/10.1101/2022.09.14.22279742v1.full.pdf

§§§ HP2030 incidence targets are based on domestically acquired infection incidence only. If the ill person did not report international travel or had unknown travel history, the illness was considered domestically acquired. A history of international travel was defined as travel ≤30 days before listeriosis and *Salmonella* Typhi and *S.* Paratyphi infection onset, ≤14 days before cyclosporiasis onset, and ≤7 days before onset for other infections. According to the Bayesian splines model, of the four illnesses with an HP2030 goal (*Campylobacter*, *Salmonella*, STEC, and *Listeria* infection), no evidence of a decrease was observed; instead, incidence of *Campylobacter* and STEC infection appears to have increased.

¶¶¶ Includes both international travel–associated infections and domestically acquired infections.

**** Infections that were not serotyped include all cases that were diagnosed by CIDT only, CIDT-diagnosed cases that failed to yield an isolate during reflex culture, and cases that yielded an isolate (both culture and CIDT-diagnosed) where the isolate was partially serotyped or not serotyped.

†††† Dashes indicate that the given data point was unknown, not reported, otherwise missing from the FoodNet data, or was not quantified.

§§§§ Incidences for STEC O157 and overall STEC non-O157 represent only a proportion of the total STEC incidence because 1,425 (43%) infections yielded an isolate, and only 1,410 (42%) were fully serogrouped and classified as STEC O157 or STEC non-O157 during 2023. Thus, IRRs for STEC O157 and STEC non-O157 partially reflect the increasing proportion of STEC infections with unknown serogroup. Infections that were not serogrouped include all cases that were diagnosed by CIDT only, CIDT-diagnosed cases that failed to yield an isolate during reflex culture, and cases that yielded an isolate in which the isolate was partially serogrouped or not serogrouped.

¶¶¶¶ The most frequently detected non-O157 serogroups were O103 (188) and O26 (173). The incidence of STEC O103 infection remained stable in 2023 compared with the 2016–2018 baseline (IRR = 0.89; 95% CrI = 0.70–1.14), and the incidence of STEC O26 infection decreased substantially (IRR = 0.75; 95% CrI = 0.63–0.90) during 2023.

***** Includes only domestically acquired infections (those for which the patient had no history of international travel or unknown travel history).

††††† The incidence of domestically acquired STEC O103 infection remained stable in 2023 compared with the 2016–2018 baseline (IRR = 0.86; 95% CrI = 0.67–1.11), and the incidence of domestically acquired STEC O26 infection decreased substantially (IRR = 0.77; 95% CrI = 0.66–0.93) during 2023.

§§§§§ For ease of comparison with the HP2030 goal, the reported incidence of domestically acquired *Listeria* infections during 2023 is shown to the second decimal place.

Generally, the overall percentage of infections attributable to specific *Campylobacter, Shigella, Vibrio,* and *Yersinia* species, *Salmonella* serotypes, and STEC serogroups was lower in 2023 than in all previous years (Table 3). The overall incidence of infections for which the pathogen was not speciated, serotyped, or serogrouped increased substantially compared with incidence during 2016–2018 (Table 2). During 2023, 78% of all bacterial infections were diagnosed by CIDTs in the historic catchment area, including 46% diagnosed using only CIDTs. The percentage of CIDT-diagnosed infections for which a reflex culture*** was attempted decreased from 71% during 2016–2018 to 68% during 2023. This decrease was largest for *Yersinia*, *Vibrio*, and STEC infections. For all illnesses except listeriosis, the percentage of reflex cultures that yielded an isolate (successful [or positive] reflex culture) was lower in 2023 than during previous years (Table 3). This decrease in isolate availability has been associated with a decrease in serotyped, serogrouped, and speciated infections. For example, from 2016–2018 to 2023, the overall incidence of unspeciated infections increased substantially for *Campylobacter*,††† *Shigella*,§§§ *Yersinia*,¶¶¶ and *Vibrio*****; the percentage of speciated infections declined from 33% to 26% for *Campylobacter*, from 65% to 41% for *Shigella*, from 49% to 23% for *Yersinia*, and from 61% to 34% for *Vibrio*. Although only culture-independent methods are used to diagnose cyclosporiasis, increases in CIDT-diagnosed cyclosporiasis and cyclosporiasis incidence mirror CIDT-driven increases in bacterial infection incidence.

*** CIDTs do not require culturing for diagnosis; however, reflex culture might be attempted after CIDT-based diagnosis. Reflex culture refers to attempting to grow and isolate the detected pathogen in a laboratory culture medium after a positive CIDT test result. Reflex culture practices vary by diagnostic laboratory, state, and pathogen.

††† The most frequently reported *Campylobacter* species in the historic catchment area during 2023 were *C. jejuni* (2,672), *C. coli* (316), *C. upsaliensis* (79), *C ureolyticus* (19), and *C. lari* (13). Compared with 2016–2018, incidence of unspeciated campylobacteriosis increased substantially in 2023 (IRR = 1.31; 95% CrI = 1.19–1.45).

§§§ The most frequently reported *Shigella* species in the historic catchment area during 2023 were *S. flexneri* (926), *S. sonnei* (364), *S. boydii* (14), and *S. dysenteriae* (three). Incidence of unspeciated shigellosis increased substantially in 2023 compared with 2016–2018 (IRR = 2.33; 95% CrI = 1.79, 3.12).

¶¶¶ The most frequently reported *Yersinia* species in the historic catchment area during 2023 were *Y. enterocolitica* (294), *Y. frederiksenii* (28), *Y. kristensenii* (19), *Y. intermedia* (eight), and *Y. massilkensis* (four). Compared with 2016–2018, incidence of unspeciated yersinosis increased substantially in 2023 (IRR = 7.19; 95% CrI = 4.78–11.97).

**** The most frequently reported *Vibrio* species in the historic catchment area during 2023 were *V. parahaemolytics* (105), *V. alginolytics* (30), *V. fluvialis* (25), *V. cholerae* (20), and *V. vulnificus* (13). Compared with 2016–2018, incidence of unspeciated vibriosis increased substantially in 2023 (IRR = 4.29; 95% CrI = 3.00–6.59).

Salmonella Infections

Of 8,454 total (i.e., both domestically acquired and travel-associated) *Salmonella* infections during 2023 in the historic catchment area, 83% yielded an isolate; 89% of isolates were fully serotyped. The incidence of nonserotyped infections increased substantially.†††† The incidences of the most frequently reported serotypes, *S.* Enteritidis and *S.* Newport, remained stable during 2023 compared with those during 2016–2018, whereas the incidences of the next-most frequently reported serotypes, *S.* Typhimurium, *S.* Javiana, and *S.* I 4,[5],12:i:- decreased substantially.

STEC Infections

Of 3,351 total STEC infections in the historic catchment area during 2023, 57% yielded an isolate; 87% of isolates were fully serogrouped. The incidence of nonserogrouped infections increased substantially in 2023 compared with that during 2016–2018.§§§§ During 2023, STEC O157 incidence decreased compared with incidence during 2016–2018, and non-O157 STEC incidence remained stable.

Hemolytic Uremic Syndrome

During 2022, FoodNet identified 61 cases of postdiarrheal HUS in persons aged <18 years, including 39 among children aged <5 years. The incidence of postdiarrheal HUS among persons aged <18 years (0.6 per 100,000 persons) and those aged <5 years (1.4 per 100,000) remained stable in 2022 compared with that during 2016–2018.¶¶¶¶

Discussion

The current findings and previous FoodNet reports (*2*,*3*) suggest a lack of progress toward foodborne disease reduction goals; however, this outcome might reflect changing diagnostic practices such as the increased use of CIDTs rather than an actual increase in disease incidence. Increased use of CIDTs facilitates prompt clinical diagnosis and treatment but also complicates the interpretation of surveillance data and trends because CIDT adoption has varied over time, among clinical labs, and by pathogen. In addition, although CIDTs are generally considered more sensitive than are culture-based methods, some have high false-positive rates for certain pathogens (e.g., *Vibrio*) (*4*–*6*). Previous studies have indicated that increased CIDT use has resulted in the diagnosis of infections that previously would have gone undetected;

†††† Overall, the most frequently reported *Salmonella* serotypes in the historic catchment area during 2023 were not serotyped infections (2,297), *S.* Enteritidis (1,597), *S.* Newport (566), *S.* Typhimurium (541), *S.* Javiana (324), and *S.* I 4,[5],12:i:- (279). The IRR for nonserotyped, domestically acquired infections in the historic catchment area was 1.67 (95% CrI = 1.38–2.01).

§§§§ STEC isolates were considered fully serogrouped if the O antigen was determined. Overall, infections in which the isolate was not serogrouped (1,941) were more frequent than infections with fully serogrouped isolates (1,410); among all fully serogrouped isolates, serogroup O157 (298) was most frequently reported in the historic catchment area during 2023, followed by O103 (188), O26 (173), and O111 (160). The IRR for nonserogrouped, domestically acquired infections during 2023 compared with 2016–2018 was 1.79 (95% CrI = 1.36–2.48).

¶¶¶¶ The IRRs for pediatric HUS cases during 2022 compared with 2016–2018 for persons aged <18 years and <5 years were 1.0 (95% CrI = 0.8–1.2) and 1.0 (95% CrI = 0.8–1.3), respectively.

TABLE 3. Percentage of bacterial infections diagnosed only by culture-based methods, and by culture-independent diagnostic tests* in the historic† catchment area during 2010–2015, 2016–2018, and 2023§,¶ — Foodborne Diseases Active Surveillance Network, United States, 2010–2018 and 2023

				Diagnosis method, no. (% of species/serotype/serogroup total**)								
	Total, no. (% of total)††			CIDT						Culture-based methods only (Cx+)		
				Any CIDT§§			Positive reflex culture (CIDT+/Cx+)					
Pathogen	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023
Campylobacter¶¶												
All* **	**44,698**	**27,977**	**11,926**	**6,517 (14.6)**	**14,867 (53.1)**	**9,704 (81.4)**	**1,157 (2.6)**	**4,912 (17.6)**	**2,867 (24.0)**	**38,181 (85.4)**	**13,110 (46.9)**	**2,222 (18.6)**
C. jejuni	14,675 (32.8)	8,024 (28.7)	2,672 (22.4)	—†††	—†††	—†††	908 (6.2)	3,397 (42.3)	2,155 (80.7)	13,767 (93.8)	4,627 (57.7)	517 (19.3)
C. coli	1,399 (3.1)	841 (3.0)	316 (2.6)	—†††	—†††	—†††	69 (4.9)	365 (43.4)	247 (78.2)	1,330 (95.1)	476 (56.6)	69 (21.8)
C. upsaliensis	332 (0.7)	188 (0.7)	79 (0.7)	—†††	—†††	—†††	10 (3.0)	115 (61.2)	74 (93.7)	332 (100.0)	73 (38.8)	5 (6.3)
C. lari	101 (0.2)	65 (0.2)	13 (0.1)	—†††	—†††	—†††	1 (1.0)	14 (21.5)	7 (53.8)	100 (99.0)	51 (78.5)	6 (46.2)
C. fetus	36 (0.1)	47 (0.2)	9 (0.1)	—†††	—†††	—†††	0 (—)†††	1 (2.1)	1 (11.1)	36 (100.0)	46 (97.9)	8 (88.9)
Other species	49 (0.1)	77 (0.3)	38 (0.3)	—†††	—†††	—†††	6 (12.2)	28 (36.4)	11 (28.9)	43 (87.8)	49 (63.6)	27 (71.1)
Not speciated	28,106 (62.9)	18,735 (67.0)	8,799 (73.8)	—†††	—†††	—†††	163 (0.6)	992 (5.3)	372 (4.2)	22,583 (80.4)	7,788 (41.6)	1,590 (18.1)

See table footnotes on page 591.

TABLE 3. (*Continued*) Percentage of bacterial infections diagnosed only by culture-based methods, and by culture-independent diagnostic tests* in the historic† catchment area during 2010–2015, 2016–2018, and 2023§,¶ — Foodborne Diseases Active Surveillance Network, United States, 2010–2018 and 2023

	Total, no. (% of total)††			Diagnosis method, no. (% of species/serotype/serogroup total**)								
				CIDT						Culture-based methods only (Cx+)		
				Any CIDT§§			Positive reflex culture (CIDT+/Cx+)					
Pathogen	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023
Salmonella§§§												
All¶¶¶	**47,131**	**25,291**	**8,454**	**1,516 (3.2)**	**7,516 (29.7)**	**5,022 (59.4)**	**778 (1.7)**	**5,177 (20.5)**	**3,496 (41.4)**	**45,615 (96.8)**	**17,775 (70.3)**	**3,432 (40.6)**
S. Enteritidis	8,396 (17.8)	4,034 (16.0)	1,597 (18.9)	—†††	—†††	—†††	103 (1.2)	988 (24.5)	901 (56.4)	8,293 (98.8)	3,046 (75.5)	696 (43.6)
S. Newport	5,258 (11.2)	2,407 (9.5)	566 (6.7)	—†††	—†††	—†††	84 (1.6)	528 (21.9)	306 (54.1)	5,174 (98.4)	1,879 (78.1)	260 (45.9)
S. Typhimurium	5,445 (11.6)	2,235 (8.8)	541 (6.4)	—†††	—†††	—†††	92 (1.7)	615 (27.5)	324 (59.9)	5,353 (98.3)	1,620 (72.5)	217 (40.1)
S. Javiana	4,261 (9.0)	1,880 (7.4)	324 (3.8)	—†††	—†††	—†††	50 (1.2)	358 (19.0)	153 (47.2)	4,211 (98.8)	1,522 (81.0)	171 (52.8)
S. I 4,[5], 12:i:-	2,227 (4.7)	1,329 (5.3)	279 (3.3)	—†††	—†††	—†††	51 (2.3)	398 (29.9)	179 (64.2)	2,176 (97.7)	931 (70.1)	100 (35.8)
Other serotypes	18,300 (38.8)	9,520 (37.6)	2,878 (34.0)	—†††	—†††	—†††	309 (1.7)	2,110 (22.2)	1,414 (49.1)	17,991 (98.3)	7,410 (77.8)	1,464 (50.9)
Not serotyped	3,244 (6.9)	3,886 (15.4)	2,269 (26.8)	—†††	—†††	—†††	89 (2.7)	180 (4.6)	219 (9.7)	2,417 (74.5)	1,367 (35.2)	524 (23.1)
STEC**												
**All†††† **	**7,824**	**7,953**	**3,351**	**5,821 (74.4)**	**7,919 (99.6)**	**3,348 (99.9)**	**4,577 (58.5)**	**4,493 (56.5)**	**1,422 (42.4)**	**2,003 (25.6)**	**34 (0.4)**	**3 (0.1)**
O157	2,905 (37.1)	1,380 (17.4)	298 (8.9)	—†††	—†††	—†††	1,932 (66.5)	1,357 (98.3)	295 (99.0)	973 (33.5)	23 (1.7)	3 (1.0)
Non-O157	3,571 (45.6)	3,120 (39.2)	1,112 (33.2)	—†††	—†††	—†††	2,605 (72.9)	3,109 (99.6)	1,112 (100.0)	966 (27.1)	11 (0.4)	0 (—)†††
Not serogrouped	1,348 (17.2)	3,453 (43.4)	1,941 (57.9)	—†††	—†††	—†††	40 (3.0)	27 (0.8)	15 (0.8)	64 (4.8)	0 (—)†††	0 (—)†††
Shigella§§§§												
All¶¶¶¶	**14,098**	**7,533**	**3,186**	**1,379 (9.8)**	**3,697 (49.1)**	**2,679 (84.1)**	**493 (3.5)**	**1,490 (19.8)**	**1,010 (31.7)**	**12,719 (90.2)**	**3,836 (50.9)**	**507 (15.9)**
S. sonnei	10,093 (71.6)	3,411 (45.3)	364 (11.4)	—†††	—†††	—†††	436 (4.3)	887 (26.0)	256 (70.3)	9,657 (95.7)	2,524 (74.0)	108 (29.7)
S. flexneri	2,142 (15.2)	1,487 (19.7)	926 (29.1)	—†††	—†††	—†††	41 (1.9)	525 (35.3)	644 (69.5)	2,101 (98.1)	962 (64.7)	282 (30.5)
S. boydii	76 (0.5)	33 (0.4)	14 (0.4)	—†††	—†††	—†††	2 (2.6)	10 (30.3)	8 (57.1)	74 (97.4)	23 (69.7)	6 (42.9)
S. dysenteriae	24 (0.2)	5 (0.1)	3 (0.1)	—†††	—†††	—†††	1 (4.2)	1 (20.0)	3 (100.0)	23 (95.8)	4 (80.0)	0 (—)†††
Not speciated	1,326 (9.4)	2,597 (34.5)	1,879 (59.0)	—†††	—†††	—†††	6 (0.5)	67 (2.6)	99 (5.3)	434 (32.7)	323 (12.4)	111 (5.9)
Yersinia*****												
**All††††† **	**951**	**1,293**	**1,437**	**26 (2.7)**	**898 (69.5)**	**1,325 (92.2)**	**4 (0.4)**	**297 (23.0)**	**247 (17.2)**	**925 (97.3)**	**395 (30.5)**	**112 (7.8)**
Y. enterocolitica	771 (81.1)	554 (42.9)	294 (20.5)	—†††	—†††	—†††	4 (0.5)	268 (48.4)	213 (72.4)	767 (99.5)	286 (51.6)	81 (27.6)
Y. frederiksenii	39 (4.1)	30 (2.3)	15 (1.0)	—†††	—†††	—†††	0 (—)†††	7 (23.3)	10 (66.7)	39 (100.0)	23 (77)	5 (33.3)
Y. intermedia	17 (1.8)	33 (2.6)	8 (0.6)	—†††	—†††	—†††	0 (—)†††	11 (33.3)	4 (50.0)	17 (100.0)	22 (66.7)	4 (50.0)
Y. kristensenii	8 (0.8)	10 (0.8)	5 (0.4)	—†††	—†††	—†††	0 (—)†††	1 (10.0)	2 (40.0)	8 (100.0)	9 (90)	3 (60.0)
Y. pseudotuberculosis	10 (1.1)	6 (0.5)	2 (0.1)	—†††	—†††	—†††	0 (—)†††	1 (16.7)	0 (—)†††	10 (100.0)	5 (83.3)	2 (100.0)
Other species	41 (4.3	11 (0.9)	7 (0.5)	—†††	—†††	—†††	0 (—)†††	3 (27.3)	4 (57.1)	41 (100,0)	8 (72.7)	3 (42.9)
Not speciated	65 (6.8)	649 (50.2)	1,106 (77.0)	—†††	—†††	—†††	0 (—)†††	6 (0.9)	14 (1.3)	43 (66.2)	42 (6.5)	14 (1.3)
Vibrio§§§§§												
All¶¶¶¶¶	**1,234**	**1,174**	**567**	**26 (2.1)**	**524 (44.6)**	**433 (76.4)**	**7 (0.6)**	**164 (14.0)**	**77 (13.6)**	**1,208 (97.9)**	**650 (55.4)**	**134 (23.6)**

See table footnotes on the next page.

TABLE 3. (*Continued*) Percentage of bacterial infections diagnosed only by culture-based methods, and by culture-independent diagnostic tests* in the historic† catchment area during 2010–2015, 2016–2018, and 2023§,¶ — Foodborne Diseases Active Surveillance Network, United States, 2010–2018 and 2023

				Diagnosis method, no. (% of species/serotype/serogroup total**)								
	Total, no. (% of total)††			CIDT						Culture-based methods only (Cx+)		
				Any CIDT§§			Positive reflex culture (CIDT+/Cx+)					
Pathogen	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023	2010–2015	2016–2018	2023
V. parahaemolyticus	692 (56.1)	403 (34.3)	105 (18.5)	—†††	—†††	—†††	4 (0.6)	112 (27.8)	52 (49.5)	688 (99.4)	290 (72.0)	53 (50.5)
V. alginolyticus	151 (12.2)	109 (9.3)	29 (5.1)	—†††	—†††	—†††	0 (—)†††	1 (0.9)	0 (—)†††	151 (100.0)	108 (99.1)	29 (100.0)
V. vulnificus	120 (9.7)	72 (6.1)	13 (2.3)	—†††	—†††	—†††	0 (—)†††	1 (1.4)	0 (—)†††	120 (100.0)	71 (98.6)	13 (100.0)
V. cholerae	68 (5.5)	73 (6.2)	20 (3.5)	—†††	—†††	—†††	1 (1.5)	21 (28.8)	13 (65.0)	67 (98.5)	52 (71.2)	7 (35.0)
V. fluvialis	73 (5.9)	55 (4.7)	25 (4.4)	—†††	—†††	—†††	1 (1.4)	8 (14.5)	8 (32.0)	72 (98.6)	47 (85.5)	17 (68.0)
Other species	84 (6.8)	25 (2.1)	5 (0.9)	—†††	—†††	—†††	1 (1.2)	5 (20)	1 (20.0)	83 (98.8)	20 (80.0)	4 (80.0)
Not speciated	692 (56.1)	437 (37.2)	370 (65.3)	—†††	—†††	—†††	0 (—)†††	16 (3.7)	3 (0.8)	27 (58.7)	62 (14.2)	11 (3.0)
Listeria monocytogenes**†	738	420	163	4 (0.5)	17 (4.0)	44 (27.0)	4 (0.5)	15 (3.6)	42 (25.8)	734 (99.5)	403 (96.0)	119 (73.0)
Total	**116,674**	**71,641**	**29,084**	**15,289 (13.1)**	**35,438 (49.5)**	**22,555 (77.6)**	**7,020 (6.0)**	**16,548 (23.1)**	**9,161 (31.5)**	**101,385 (86.9)**	**36,203 (50.5)**	**6,529 (22.4)**

Abbreviations: CIDT = culture-independent diagnostic test; CIDT+ = positive CIDT result; Cx = culture-based method; Cx+ = positive culture result; Cx– = negative culture result; FoodNet = Foodborne Diseases Active Surveillance Network; HP2030 = Healthy People 2030; STEC = Shiga toxin-producing *Escherichia coli*.

* Bacterial infections could be diagnosed by culture-based methods only (Cx+), by CIDTs only (CIDT+), or by CIDTs with a reflex culture. When diagnosed by CIDTs with a reflex culture, the culture could either yield an isolate (CIDT+/Cx+) or fail to yield an isolate (CIDT+/Cx–). Because speciation and subtyping are only possible when an isolate is available, species and subtype data are only reported in the table for infections diagnosed by culture and by CIDTs with a reflex culture that yielded an isolate (CIDT+/Cx+). To facilitate readability, data for cases diagnosed by CIDTs only (i.e., where no reflex culture was performed) is not shown; these data can be calculated by subtracting the values in the footnotes for negative reflex culture (CIDT+/Cx–) and the Positive Reflex Culture (CIDT+/Cx+) column from the Any CIDT column.

† The historic catchment area includes those sites under surveillance since 2004, including Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, Tennessee, and selected counties in California (three), Colorado (seven), and New York (34).

§ Periods were selected to facilitate comparison of 2023 data with 1) 2016–2018, the reference period used by HP2030, and 2) 2010–2015, when CIDTs were not widely available or used. Comparing 2023 data with these two periods shows increased CIDT availability and adoption have affected the reported frequency of different bacterial pathogens in the FoodNet catchment area.

¶ Case data for 2023 are preliminary.

** Percentage of cases linked to a specific species or subtype that were diagnosed by the given method. For example, in 2023, 81% of *C. jejuni* cases were diagnosed by CIDTs followed by reflex culture, and 19% were diagnosed using culture-based methods only.

†† Total number of isolates reported during that time. To obtain the average annual number reported, divide this total by the number of years. For example, 22% of *Campylobacter* isolates in 2023 were identified as *C. jejuni* (2,672), whereas 29% were identified as *C. jejuni* during 2016–2018 (8,024, or an average of 2,675 per year).

§§ Includes cases diagnosed by CIDTs only (CIDT+) or by CIDTs with either a positive (CIDT+/Cx+) or negative (CIDT+/Cx–) reflex culture.

¶¶ During 2010–2023, the other *Campylobacter* species reported, in order of frequency, were *C. ureolyticus, C. concisus, C. hyointestinalis, C. curvus, C. gracilis, C. rectus, C. sputorum, C. helveticus, C. lanienae, C. mucosalis, C. showae, C. hominis, C. paraureolyticus*, and *C. pelordis*.

*** During 2010–2015, 5% (2,404) of reported *Campylobacter* infections were diagnosed by CIDT and had a negative reflex culture (CIDT+/Cx–). During 2016–2018, 14% (3,947) of reported *Campylobacter* infections were diagnosed by CIDT+/Cx–. During 2023, 21% (2,484) of reported *Campylobacter* infections were diagnosed by CIDT+/Cx–.

††† Dashes indicate that the given data point could not be quantified because of the absence of isolates for cases diagnosed by CIDT in which reflex culture was not performed or reflex culture was negative. Illnesses diagnosed by CIDT in which reflex culture was not performed or reflex culture was negative lack an isolate. As a result, these infections cannot be attributed to a specific species, serotype or serogroup.

§§§ During 2010–2023, other commonly identified *Salmonella* serotypes (at least 1,000 cases) were, in order of frequency: Infantis, Saintpaul, Muenchen, Montevideo, Braenderup, Oranienburg, Thompson, Heidelburg, Bareilly, Mississippi, and I 13,23:b:-.

¶¶¶ During 2010–2015, 0.3% (155) of reported *Salmonella* infections were diagnosed by CIDT+/Cx–. During 2016–2018, 3% (730) of reported *Salmonella* infections were diagnosed by CIDT+/Cx–. During 2023, 8% (707) of reported *Salmonella* infections were diagnosed by CIDT+/Cx–.

**** During 2010–2023, the most common non-O157 STEC subtypes reported (more than 500 isolates), in order of frequency, were O26, O103, O111, and O121.

†††† During 2010–2015, 11% (860) of reported STEC infections were diagnosed by CIDT+/Cx–. During 2016–2018, 31% (2,442) of reported STEC infections were diagnosed by CIDT+/Cx–. During 2023, 33% (1,094) of reported STEC infections were diagnosed by CIDT+/Cx–.

§§§§ The increase in reflex cultures that fail to yield an isolate might be partially attributable to the fact that existing CIDT panels cannot distinguish between *Shigella* and enteroinvasive *E. coli*.

¶¶¶¶ During 2010–2015, 1% (204) of reported *Shigella* infections were diagnosed by CIDT+/Cx–. During 2016–2018, 14% (1,073) of reported *Shigella* infections were diagnosed by CIDT+/Cx–. During 2023, 36% (1,151) of reported *Shigella* infections were diagnosed by CIDT+/Cx–.

***** During 2010–2023, the other *Yersinia* species reported, in order of frequency, were *Y. ruckeri, Y. massiliensis, Y. aldovae, Y. mollaretii, Y. aleksiciae, Y. rohdei*, and *Y. bercovieri*.

††††† During 2010–2015, 0.5% (5) of reported *Yersinia* infections were diagnosed by CIDT+/Cx–. During 2016–2018, 25% (322) of reported *Yersinia* infections were diagnosed by CIDT+/Cx–. During 2023, 31% (443) of reported *Yersinia* infections were diagnosed by CIDT+/Cx–.

§§§§§ During 2010–2023, the other *Vibrio* species reported, in order of frequency, were *V. mimicus, V. hollisae, V. furnissii, V. damsela, V. metschnikovii, V. cincinnatiensis, V. harveyi, V. navarrensis, V. fischeri*, and *V. metoecus*.

¶¶¶¶¶ During 2010–2015, 1% (12) of reported *Vibrio* infections were diagnosed by CIDT+/Cx–. During 2016–2018, 23% (272) of reported *Vibrio* infections were diagnosed by CIDT+/Cx–. During 2023, 37% (211) of reported *Vibrio* infections were diagnosed by CIDT+/Cx–.

****** During 2010–2015, no *Listeria monocytogenes* infections were diagnosed by CIDT+/Cx–. During 2016–2018, 0.5% (2) of reported *L. monocytogenes* infections were diagnosed by CIDT+/Cx–. During 2023, 0.6% (1) of reported *L. monocytogenes* infections were diagnosed by CIDT+/Cx–.

Summary

What is already known about this topic?

Increased use of culture-independent diagnostic tests (CIDTs) affects observed trends in foodborne infection incidence.

What is added by this report?

During 2023, the incidence of eight domestically acquired infections transmitted commonly through food either increased or remained stable compared with 2016–2018, the baseline used to track progress toward disease reduction goals. Incidence of CIDT-diagnosed infection also increased during 2023.

What are the implications for public health practice?

CIDTs allow for diagnosis of infections that previously would have been undetected; recent increases in incidence appear to be driven by increased CIDT use. Continued surveillance is needed to monitor the impact of changing diagnostic practices on disease trends. Targeted prevention efforts are needed to reduce disease incidence.

increased use of CIDTs has been associated with marked increases in reported incidence (*4*,*7*).

Increases in CIDT-diagnosed infections are also associated with decreased rates of reflex culture, thereby reducing the number of isolates available for subtyping, whole genome sequencing, and antimicrobial resistance characterization (*8*). The impact of this reduction differs by species, serotype, and serogroup. Because an isolate is required for speciation, serotyping, and serogrouping, reduced isolate availability might result in underdetection of illnesses attributable to specific *Campylobacter, Shigella, Vibrio,* and *Yersinia* species, *Salmonella* serotypes, and STEC serogroups. The substantial increase in the incidence of infections for which the pathogen was not speciated, serotyped, or serogrouped is likely an artifact of changing diagnostic practices (i.e., increased CIDT use), resulting in a reduced availability of isolates for speciation and typing. Continued reductions in isolate availability might hinder outbreak identification and response (e.g., whole genome sequencing–based cluster identification and source attribution), detection of emerging antimicrobial resistance, and tracking of trends in illnesses attributable to specific species, subtypes, serotypes, and resistant strains. Increasing successful reflex culture rates after a CIDT diagnosis is a public health priority, which requires focused efforts and resources at the federal, state, and local levels.

FoodNet data are used to track trends in enteric illness, monitor progress toward disease reduction goals, and guide food safety policy*****,††††† (*1*). Because FoodNet is a sentinel surveillance system representing 10 sites, national extrapolation relies on strong assumptions of representativeness. Although the sites included in the FoodNet catchment area were selected nonrandomly, past analyses suggest that FoodNet's catchment area is broadly representative of the national population (*9*,*10*). Previously, the only notable difference between FoodNet's historic catchment area and the national population identified by these studies was that Hispanic persons were underrepresented in the catchment area relative to national representation (*9*,*10*). Investigating enteric disease epidemiology for AI/AN and NH/PI persons using FoodNet data has also been complicated by the small size of these populations in the historic catchment area. By increasing representation for these specific populations in the FoodNet catchment area, FoodNet's expansion has helped to partially alleviate these limitations and improve the generalizability of FoodNet data. Additional expansion might be needed as national and catchment area demographics change.

Limitations

The findings in this report are subject to at least three limitations. First, underreporting might affect case counts because ill persons must seek care and be tested for their illness to be recorded as a case. Second, although ill persons might meet the FoodNet criteria for hospitalization or death, the underlying reason for hospitalization or death might be unknown. Deaths that occurred >1 week after specimen collection among nonhospitalized persons or after discharge for hospitalized persons might not be recorded. Finally, domestically acquired cases might be overestimated because of the inclusion of persons with unknown travel status.

Implications for Public Health Practice

FoodNet's surveillance efforts are critical for tracking foodborne and enteric illnesses in the United States. During 2023, FoodNet expanded its catchment area for the first time since 2004, and it now includes all of Colorado. This expansion improved the representativeness of the FoodNet catchment area, and the ability of FoodNet to monitor trends in disease incidence, including the impact of changing diagnostic practices and the generalizability of FoodNet data. Continued surveillance is needed to monitor the impact of changing diagnostic practices on disease trends and evaluate the efficacy of prevention efforts in reducing incidence.

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***** https://www.fsis.usda.gov/inspection/inspection-programs/inspection-poultry-products/reducing-salmonella-poultry

††††† https://www.fsis.usda.gov/policy/federal-register-rulemaking/federal-register-notices/changes-salmonella-verification-0

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Reported Xylazine Use Among Adults Aged ≥18 Years Evaluated for Substance Use Treatment — United States, July 2022–September 2023

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Abstract

Xylazine has been increasingly detected in illegally manufactured fentanyl (IMF) products and overdose deaths in the United States; most xylazine-involved overdose deaths involve IMF. A convenience sample of U.S. adults aged ≥18 years was identified from those evaluated for substance use treatment during July 2022–September 2023. Data were collected using the Addiction Severity Index-Multimedia Version clinical assessment tool. Among 43,947 adults, 6,415 (14.6%) reported IMF or heroin as their primary lifetime substance-use problem; 5,344 (12.2%) reported recent (i.e., past–30-day) IMF or heroin use. Among adults reporting IMF or heroin as their primary lifetime substance-use problem, 817 (12.7%) reported ever using xylazine. Among adults reporting recent IMF or heroin use, 443 (8.3%) reported recent xylazine use. Among adults reporting IMF or heroin use recently or as their primary lifetime substance-use problem, those reporting xylazine use reported a median of two past nonfatal overdoses from any drug compared with a median of one overdose among those who did not report xylazine use; as well, higher percentages of persons who reported xylazine use reported other recent substance use and polysubstance use. Provision of nonjudgmental care and services, including naloxone, wound care, and linkage to and retention of persons in effective substance use treatment, might reduce harms including overdose among persons reporting xylazine use.

Introduction

Xylazine, a nonopioid sedative, has been increasingly detected in illegally manufactured fentanyl (IMF) products* and in U.S. overdose deaths (*1*). Most detected xylazine-involved overdose deaths also involve IMF (*2*); IMF-involved deaths with xylazine detected rose 276% in 21 jurisdictions during January 2019–June 2022 (*3*). Drugs sold as heroin increasingly contain IMF, which could lead persons seeking heroin to consume IMF, either knowingly or unknowingly (*4*,*5*). Xylazine has also been associated with skin lesions (*6*) that appear to be independent of the route of xylazine administration.† To guide the development and implementation of prevention and response efforts, a cross-sectional U.S. study examining characteristics of adults evaluated for substance use treatment who reported IMF or heroin use and who also responded to questions about xylazine use was conducted.

Methods

Data Source

A convenience sample of U.S. adults aged ≥18 years evaluated for substance use treatment was identified using the validated, self-administered Addiction Severity Index-Multimedia Version (ASI-MV) clinical assessment tool§ during July 2022–September 2023 (*7*). The ASI-MV tool, an instrument integral to the National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) and used for clinical treatment planning and triage purposes, is administered at substance-use treatment and other facilities or programs (including criminal justice programs, drug courts, and homeless services) and collects information on demographic characteristics, substance use patterns, routes of drug administration, and overdose history. Data were obtained from responses to the NAVIPPRO ASI-MV tool. Adults included in the analysis were those who responded to questions about xylazine use among those who reported IMF or heroin use. Xylazine was identified in ASI-MV as "xylazine (sometimes combined with heroin, fentanyl, or cocaine; sometimes known as sleep cut/tranq dope/Anestesia de Caballo)."

Statistical Analysis

Wilcoxon rank-sum tests for continuous variables and Pearson's chi-square tests for categorical variables¶ were used to compare the distribution of demographic characteristics for the following groups: 1) adults reporting ever versus never

* Pharmaceutical fentanyl is a highly potent (50–100 times more potent than morphine) synthetic opioid indicated for the treatment of severe pain. IMF is produced and sold through illegal drug markets and is often mixed with heroin or cocaine. Information on fentanyl overdose prevention is available: https://www.cdc.gov/overdose-prevention/about/fentanyl.html?CDC_AAref_Val = https://www.cdc.gov/opioids/basics/fentanyl.html

† https://hip.phila.gov/document/3154/PDPH-HAN_Update_13_Xylazine_12.08.2022.pdf/

§ Adults could be assessed by ASI-MV multiple times. To analyze data at the person level, for adults with multiple assessments, the most recent assessment was selected if multiple assessments were performed on the same day; for adults with multiple assessments collected on different days, the earliest assessment was selected.

¶ The "unknown" or "no response" categories for each demographic characteristic and all variables related to substance use were excluded from the Wilcoxon rank-sum tests and Pearson's chi-square tests.

using xylazine, among adults reporting IMF or heroin as their primary lifetime substance use problem**; and 2) adults reporting recent (i.e., past–30-day) xylazine use†† versus no recent xylazine use,§§ among adults reporting recent IMF or heroin use. P-values <0.05 (two-sided) were considered statistically significant. Analyses were conducted using SAS (version 9.4: SAS Institute). This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶¶

Results

Study Participants

Among 45,015 unique adults who completed assessments during the study period, 31,675 (70.4%) were assessed in the southern United States; 1,068 (2.4%) persons were excluded because they did not respond to the xylazine questions.*** Among the remaining 43,947 respondents, 6,415 (14.6%) reported IMF or heroin as their primary lifetime substance use problem, and 5,344 (12.2%) reported recent IMF or heroin use.††† Among all 43,947 respondents, a total of 1,924 (4.4%) reported ever using xylazine.

Xylazine Use Among Adults Reporting IMF or Heroin as Their Primary Lifetime Substance-Use Problem

Among 6,415 adults reporting IMF or heroin as their primary lifetime substance-use problem, 817 (12.7%) reported ever using xylazine. The median age of persons in this group was 34.0 years (IQR = 29.0–40.0 years); most were male (60.7%), non-Hispanic White (78.0%), had a high school education or less (73.5%), and had ever started treatment for substance use (77.6%) (Table). No statistically significant differences in age, sex, education, primary substance-use problem, or history of starting treatment for substance use were identified among adults who reported ever versus never using xylazine; however, a higher percentage of persons who ever used xylazine reported using at least one other substance recently (p<0.01). Further, the percentage of those who reported polysubstance use (use of two or more other substances apart from IMF or heroin and xylazine)§§§ during the preceding 30 days was higher among those who had ever used xylazine (57.2%) than that among those who had never used it (36.1%) (p<0.01). Those reporting ever using xylazine reported more lifetime nonfatal overdoses from any drug (median = two) than did those who never used xylazine (median = one) (p<0.01).

The most common substances used during the preceding 30 days by persons reporting ever using xylazine were misused prescription opioids (63.4%),¶¶¶,**** IMF (60.6%), and heroin (45.4%). Recent prescription opioid misuse was nearly twice as common among those who reported ever (63.4%) versus never (35.8%) using xylazine. The majority of respondents (58.5%) reported using xylazine by swallowing, snorting or sniffing, or smoking, without injection; nearly one third (31.7%) reported injecting xylazine.

Xylazine Use Among Adults Reporting Recent IMF or Heroin Use

Among 5,344 adults reporting recent (past–30-day) IMF or heroin use, 443 (8.3%) reported past–30-day xylazine use (Table). Compared with the percentage of adults who reported no recent xylazine use, higher percentages of persons with recent xylazine use were female (42.0% versus 34.7%; p<0.01) and reported other recent polysubstance use (84.9% versus 57.8%; p<0.01). Persons reporting recent xylazine use reported a median of two lifetime nonfatal overdoses from any drug compared with a median of one among those without recent xylazine use (p<0.01). Most persons (65.2%) reported using xylazine by swallowing, snorting or sniffing, or smoking,

** NAVIPPRO defined the primary lifetime substance use problem as the primary or most serious problem persons reported among the substances they used in their lifetime (only one substance could be selected). The definitions of IMF and heroin in the ASI-MV were "Street fentanyl (illegal fentanyl, carfentanil – sometimes combined with other drugs such as heroin or cocaine)," and "heroin," respectively.

†† Days of xylazine use and IMF or heroin use might or might not overlap.

§§ The no recent xylazine use category includes adults who never used xylazine or those who last used xylazine >30 days earlier.

¶¶ 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.

*** During the study period, 48,872 assessments were completed by 45,015 unique persons from 358 sites located in 32 states (7.8% of assessments were repeat assessments, meaning that they were completed by a person who had already completed one assessment). Among the 45,015 unique persons, 2,602 (5.8%) were assessed in the Northeast, 4,427 (9.8%) in the Midwest, 31,675 (70.4%) in the South, and 6,311 (14.0%) in the West. Overall, 1,068 unique adults did not respond to the xylazine question and were excluded.

††† The 5,344 persons who reported recent IMF or heroin use included 3,936 (73.7%) persons who reported IMF or heroin as their primary lifetime substance use problem. An additional 1,408 (26.3%) persons reported recent IMF or heroin use but did not report IMF or heroin as their primary substance use problem.

§§§ Polysubstance use (apart from IMF or heroin and xylazine) includes past–30-day use (or prescription medication misuse) of at least two of the following: alcohol; cannabis; cocaine or crack; prescription opioid (misuse); prescription stimulant (misuse); illegal stimulant use; prescription sedatives, tranquilizers, or sleeping pills use; barbiturates; hallucinogens; inhalants; GHB; ketamine; K2; Rohypnol; over-the-counter medications; and other unspecified drugs. Polysubstance use here does not necessarily represent use of substances simultaneously.

¶¶¶ Prescription opioid misuse is any use that is not considered "use as prescribed." For prescription opioids, "use as prescribed" requires 1) having a current pain problem and taking a prescribed opioid medication for pain during the past 30 days; 2) obtaining the medication only using one's own prescription; and 3) no use of the medication via any route of administration other than that prescribed.

**** Nonmutually exclusive sources of past–30-day misused prescription opioids among 518 adults reporting primary IMF or heroin use and any xylazine use were "own prescription" (332; 64.1%), "dealer" (178; 34.4%), "family/friend" (149; 28.8%), "other source" (119; 23.0%), "stolen" (21; 4.1%), "internet" (9; 1.7%), and "prescription forgery" (6; 1.2%).

TABLE. Characteristics of adults evaluated for substance use treatment, by reported xylazine use — United States, July 2022–September 2023

Characteristic	No. (%)					
	Xylazine use among adults reporting IMF or heroin as their primary lifetime substance-use problem n = 6,415			Past–30-day xylazine use among adults reporting past–30-day IMF or heroin use n = 5,344*		
	Ever used n = 817 (12.7%)	Never used n = 5,598 (87.3%)	p-value	Yes n = 443 (8.3%)	No n = 4,896 (91.6%)	p-value
Median age, yrs (IQR)	34.0 (29.0–40.0)	34.0 (29.0–40.0)	0.21	34.0 (30.0–41.0)	34.0 (29.0–41.0)	0.23
Sex						
Female	319 (39.1)	2,005 (35.8)	0.07	186 (42.0)	1,700 (34.7)	<0.01
Male	496 (60.7)	3,592 (64.2)		256 (57.8)	3,194 (65.2)	
Unknown/No response	2 (0.2)	1 (0.02)		1 (0.2)	2 (0.0)	
Race and ethnicity						
AI/AN, NH	16 (2.0)	194 (3.5)	<0.01	12 (2.7)	168 (3.4)	0.03
Black or African American, NH	51 (6.2)	536 (9.6)		32 (7.2)	502 (10.3)	
White, NH	637 (78.0)	4,080 (72.9)		343 (77.4)	3,478 (71.0)	
Hispanic or Latino	60 (7.3)	494 (8.8)		28 (6.3)	462 (9.4)	
Other, NH	53 (6.5)	294 (5.3)		28 (6.3)	286 (5.8)	
Highest education level achieved						
Less than high school	204 (25.0)	1,326 (23.7)	0.41	100 (22.6)	1,208 (24.7)	0.59
High school	396 (48.5)	2,848 (50.9)		227 (51.2)	2,472 (50.5)	
Any college	217 (26.6)	1,415 (25.3)		115 (26.0)	1,207 (24.7)	
Unknown/No response	0 (—)	9 (0.16)		1 (0.2)	9 (0.2)	
Entered treatment for substance use (e.g., alcohol or drugs or both) during lifetime						
Yes	634 (77.6)	4,365 (78.0)	0.65	318 (71.8)	3,663 (74.8)	0.12
No	116 (14.2)	839 (15.0)		85 (19.2)	803 (16.4)	
Unknown/No response	67 (8.2)	394 (7.0)		40 (9.0)	430 (8.8)	
Route of xylazine use†						
Injection drug use	259 (31.7)	NA	NA	136 (30.7)	NA	NA
No injection drug use	478 (58.5)	NA		289 (65.2)	NA	
Unknown/No response	80 (9.8)	NA		18 (4.1)	NA	
Substance use in the past 30 days (i.e., recent substance use)						
Alcohol	222 (27.2)	1,201 (21.5)	<0.01	200 (45.2)	1,753 (35.8)	<0.01
Cannabis§	307 (37.6)	1,292 (23.1)	<0.01	248 (56.0)	1,777 (36.3)	<0.01
Cocaine or crack	166 (20.3)	721 (12.9)	<0.01	173 (39.1)	1,190 (24.3)	<0.01
Heroin	371 (45.4)	1,722 (30.8)	<0.01	338 (76.3)	2,497 (51.0)	<0.01
Illegal stimulant¶	300 (36.7)	1,086 (19.4)	<0.01	268 (60.5)	1,718 (35.1)	<0.01
IMF	495 (60.6)	2,874 (51.3)	<0.01	419 (94.6)	4,073 (83.2)	<0.01
Prescription opioid misuse**	518 (63.4)	2,006 (35.8)	<0.01	333 (75.2)	2,038 (41.6)	<0.01
Prescription sedative, tranquilizer, or sleeping pill††	174 (21.3)	721 (12.9)	<0.01	159 (35.9)	995 (20.3)	<0.01
Prescription stimulant misuse§§	37 (4.5)	83 (1.5)	<0.01	50 (11.3)	135 (2.8)	<0.01
Xylazine	326 (39.9)	0 (—)	<0.01	443 (100.0)	0 (—)	<0.01
Other substances¶¶	148 (18.1)	221 (4.0)	<0.01	151 (34.1)	405 (8.3)	<0.01
Past–30-day polysubstance use (use of ≥2 other substances, apart from IMF or heroin and xylazine)* **						
Yes	467 (57.2)	2,020 (36.1)	<0.01	376 (84.9)	2,832 (57.8)	<0.01
No	350 (42.8)	3,578 (63.9)		67 (15.1)	2,064 (42.2)	
Median no. of other substances used in the past 30 days, (IQR)†††	2.0 (1.0–4.0)	1.0 (0.0–2.0)	<0.01	3.0 (2.0–5.0)	2.0 (1.0–3.0)	<0.01
Primary substance use problem						
Heroin	332 (40.6)	2,334 (41.7)	0.57	97 (21.9)	1,051 (21.5)	0.65
IMF	485 (59.4)	3,264 (58.3)		217 (49.0)	2,566 (52.4)	
Other substances or none	0 (—)	0 (—)		117 (26.4)	1,256 (25.7)	
Unknown/No response	0 (—)	0 (—)		12 (2.7)	23 (0.5)	
Median no. of lifetime nonfatal overdoses related to any drug, (IQR)§§§	2.0 (0.0–5.0)	1.0 (0.0–4.0)	<0.01	2.0 (0.0–5.0)	1.0 (0.0–4.0)	<0.01

See table footnotes on the next page.

TABLE. (*Continued*) Characteristics of adults evaluated for substance use treatment, by reported xylazine use — United States, July 2022–September 2023

Source: The National Addictions Vigilance Intervention and Prevention Program Addiction Severity Index-Multimedia Version data sets July 2022–September 2023. The unit of analysis was each adult.

Abbreviations: AI/AN = American Indian or Alaska Native; IMF = illegally manufactured fentanyl; NA = not applicable; NH = non-Hispanic.

* Among 5,344 adults, 5 (0.1%) did not respond to question related "xylazine use in the past 30-day." "No xylazine use past 30 days" includes adults who never used xylazine or those who used xylazine >30 days ago. Days of xylazine use and use of IMF, heroin, or both in the past 30 days might or might not overlap.

† For the "no injection drug use" category, swallowed, snorted or sniffed, or smoked was reported. For the "injection drug use" category, swallowed, snorted or sniffed, or smoked might also be reported.

§ Cannabis is defined as marijuana, hashish, or a prescription cannabinoid product (e.g., Cesamet or Marinol).

¶ Illegal stimulant included bath salts, ecstasy, illegal methamphetamines, or a combination of these.

** Prescription opioids include selection of past–30-day misuse of one or more prescription opioid medications, such as Oxycontin, oxycodone, Vicodin, Percocet, methadone, or buprenorphine. Prescription opioid misuse is any use that is not considered "use as prescribed." For prescription opioids, "use as prescribed" requires 1) having a current pain problem and taking a prescribed opioid medication for pain during the past 30 days, 2) obtaining the medication only from one's own prescription, and 3) no use of the medication via any route of administration other than what was prescribed. Regarding the source of past–30-day misused prescription opioids among "xylazine use past 30 days" category (333), "own prescription" was the most common source (184; 55.3%), followed by "dealer" (159; 47.8%), "family/friend" (119; 35.7%), "other source" (105; 31.5%), "stolen" (28; 8.4%), "internet" (13; 3.90%), and "prescription forgery" (10; 3.0%). Sources of procurement were not mutually exclusive.

†† Prescription sedatives, tranquilizers, or sleeping pills, such as Ambien, Klonopin, Lunesta, Valium, or Xanax, might be misused or used as prescribed.

§§ Prescription stimulants include selection of past–30-day misuse of prescription stimulant medications, such as amphetamine (e.g., Adderall or Vyvanse) or methylphenidate (e.g., Concerta, Focalin, or Ritalin). Prescription stimulant misuse is any use that is not considered "use as prescribed." For prescription stimulants, "use as prescribed" is defined as obtaining the stimulant medication only from one's own prescription and no use of the medication via any route of administration other than what was prescribed. Misuse is also assigned if a respondent indicates having used the medication during the past 30 days, "not in a way prescribed by your doctor to treat a diagnosed attention deficit or hyperactivity disorder."

¶¶ Other substances included barbiturates such as phenobarbital, Seconal, and Fiorinal (barbs, reds, or downers); hallucinogens like LSD or acid, PCP, mushrooms, or angel dust; inhalants like glue, paint, gasoline, or nitrous oxide; GHB (G, Liquid G, Liquid X, or Fantasy); ketamine (K, Special K, or Vitamin K); K2 (spice or synthetic cannabis); Rohypnol (Roche, Roofies, or Rope); over-the-counter medication, such as cough medicine, taken not as directed; and other (or unknown).

*** Past–30-day polysubstance use includes past–30-day use (or prescription medication misuse) of at least two of the following substances: alcohol; cannabis; cocaine or crack; prescription opioid (misuse); prescription stimulant (misuse); illegal stimulant use; prescription sedatives, tranquilizers, or sleeping pills use; barbiturates; hallucinogens; inhalants; GHB; ketamine; K2; Rohypnol; over-the-counter medications; and other unspecified drugs. Polysubstance use here does not necessarily represent use of substances simultaneously.

††† Excluding IMF, heroin, and xylazine. Other substances include alcohol; cannabis; cocaine or crack; prescription opioid (misuse); prescription stimulant (misuse); illegal stimulant use; prescription sedatives, tranquilizers, or sleeping pills use; barbiturates; hallucinogens; inhalants; GHB; ketamine; K2; Rohypnol; over-the-counter medications; and other unspecified drugs.

§§§ The sample size is 815 among the "Ever used xylazine" category, 5,570 among the "Never used xylazine" category, 430 among the "Xylazine use past 30 days" category, and 4,849 among the "No xylazine use past 30 days" category.

without injection; 30.7% reported injecting xylazine. Among persons reporting recent IMF or heroin use, a higher percentage of those reporting recent xylazine use reported other recent substance use (range = 11.3% [prescription stimulant misuse] to 94.6% [IMF]) than did persons who did not report recent xylazine use (range = 2.8% [prescription stimulant misuse] to 83.2% [IMF]) (all p-values <0.01).

Discussion

Among adults evaluated for substance use treatment and reporting IMF or heroin use during the past 30 days or as their primary lifetime substance use problem, those reporting xylazine use reported more past nonfatal overdoses; as well higher percentages of persons who reported xylazine use reported other recent substance use and polysubstance use than did those who did not report xylazine use. Whether xylazine increases IMF-involved overdose risk is not clear (*5*); a previous analysis found that overdose circumstances and other drug co-involvement were largely similar between IMF-involved deaths with and without xylazine detected (*3*). Reported xylazine exposure might be associated with higher numbers of nonfatal overdoses because both nonfatal overdoses (*8*) and xylazine exposure are associated with polysubstance use, consistent with the finding in this report. Although naloxone cannot reverse the effects of xylazine, its distribution should be expanded because xylazine is most commonly combined with IMF, the effects of which do respond to naloxone (*3*,*5*,*9*). More research is needed to understand whether xylazine use might indicate other polysubstance use or might be associated with unique withdrawal and dependence syndromes and the implications for treatment of concomitant opioid use disorder (*5*,*9*).

Data to guide development and implementation of recommendations for treatment of persons with xylazine use are limited; however, recent reviews have noted that persons with extensive xylazine-associated skin involvement might experience additional difficulties accessing needed services, including substance use treatment and wound care, which can, in turn, exacerbate substance use and interfere with wound healing (*5*,*9*). Reducing stigma associated with substance use, and specifically with wounds as a sign of substance use, is an important component of linking and retaining persons with substance-associated skin involvement in low-barrier substance use treatment programs as a means to help them access harm reduction services and wound care (*5*). Parameters for use and timing of clinical testing for xylazine use have not been clearly defined (*5*); however, persons who use illicit drugs, including opioids, cocaine or crack, or amphetamine-type drugs, have

Summary

What is already known about this topic?

Xylazine, a nonopioid sedative, has been increasingly detected in illegally manufactured fentanyl (IMF) and IMF-involved U.S. overdose deaths; most xylazine-involved overdose deaths involve IMF.

What is added by this report?

Among adults evaluated for substance use treatment and reporting past–30-day IMF or heroin use or IMF or heroin as their primary lifetime substance use problem, those also reporting xylazine use reported more past nonfatal overdoses, and higher percentages of persons who reported xylazine use reported other recent substance use and polysubstance use than did persons who did not report xylazine use.

What are the implications for public health practice?

Provision of nonjudgmental care and services and linkage to and retention in effective substance use treatment might reduce harms, including overdose among persons reporting xylazine use.

reported a desire for xylazine test strips (*10*). Expanding clinical care and drug checking programs (including, for example, provision of fentanyl and xylazine test strips) might facilitate engagement of persons who use drugs in harm reduction services and help them limit the potential for associated harms.

Limitations

The findings in this report are subject to at least seven limitations. First, xylazine use could be under- or overreported. Information was not available concerning the validity of self-reported xylazine use, including whether presence of xylazine was confirmed with test strips or whether respondents believed they consumed xylazine. Of note, xylazine or IMF is often mixed with other substances, and respondents might have been unaware of their exposures (*2*,*3*,*10*), potentially leading to underreporting of actual xylazine or IMF exposure. Second, ASI-MV data are self-reported and subject to social desirability, reporting biases, and recall error. Third, persons who use multiple substances might be more likely to have heard of xylazine and, therefore, more likely to report using xylazine. Fourth, the ASI-MV does not ask whether persons intentionally used xylazine or were simply exposed to it as an adulterant of other drugs. A survey of persons who inject drugs in Philadelphia found that whereas some persons might seek xylazine, most prefer not to use xylazine (*4*). This preference might be due to concerns about negative effects of xylazine, such as worsened withdrawal symptoms and wounds (*2*,*4*). Fifth, for each substance used, no start and end use dates were recorded; thus, identifying adults using xylazine and other substances simultaneously was not possible. Sixth, because of the study design, xylazine use without IMF or heroin (e.g., xylazine used with cocaine) was not reported. Future study is needed to explore the characteristics of this population and help them mitigate any associated harms. Finally, data are a convenience sample, and most assessments came from the southern United States; xylazine presence varies in the illicit drug supply across the United States.†††† Thus, results might not be generalizable to all U.S. adults being assessed for substance use treatment.

Implications for Public Health Practice

Most fatal overdoses involving xylazine in the United States also involve IMF (*2*); to reduce fatal overdoses, linking and retaining persons who use xylazine in effective substance use treatment, including medications for opioid use disorder as indicated, and expanding naloxone distribution are critical. To help engage persons who use drugs in treatment, mitigate harms of drug use, and build trust among persons not yet ready for substance use treatment, jurisdictions can expand access to harm reduction services, including xylazine test strips and wound care. Broader interventions are needed to reduce stigma directed toward persons who use drugs and increase awareness of their treatment and service needs so that services can be accessed without judgment.

†††† https://www.dea.gov/sites/default/files/2022-12/The%20Growing%20Threat%20of%20Xylazine%20and%20its%20Mixture%20with%20Illicit%20Drugs.pdf; https://www.muni.org/Departments/Assembly/Documents/Webpage%20-%20Health%20Policy%20Committee/VOA%20Alaska%20-%20Millennium%20Health%20Signals%20Report%20Xylazine.pdf

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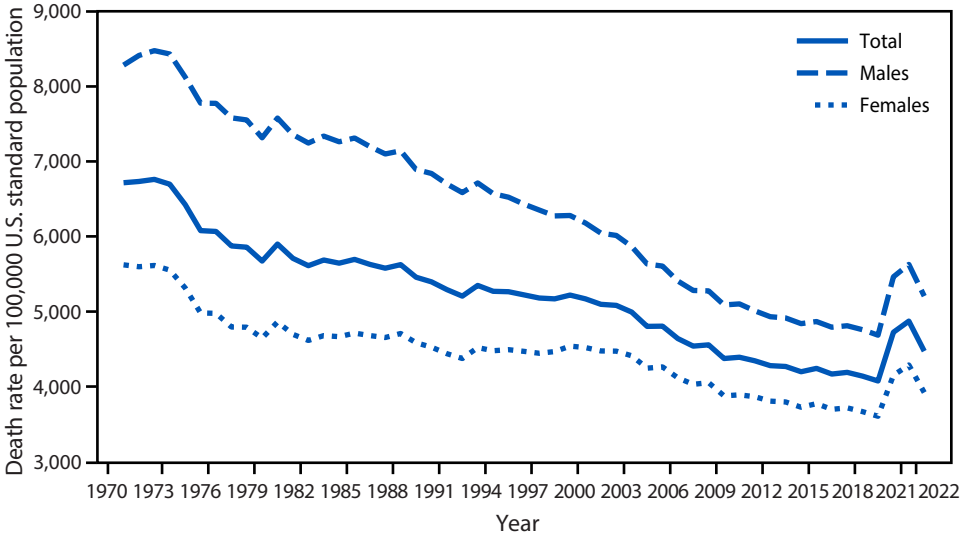
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rate* Among Adults Aged ≥65 Years, by Sex — United States, 1970–2022



* Age-adjusted death rates are deaths per 100,000 population, adjusted to the 2000 U.S. standard population.

The age-adjusted death rate among adults aged ≥65 years declined from 6,717.6 per 100,000 standard population in 1970 to 4,073.8 in 2019. Death rates increased in 2020 and 2021 but then declined to 4,470.0 in 2022. The pattern was similar for males and females, although death rates for males were higher than those for females throughout the period 1970–2022.

Supplementary Table: https://stacks.cdc.gov/view/cdc/156507

Source: National Center for Health Statistics, National Vital Statistics System, Mortality Data, 1970–2022. https://www.cdc.gov/nchs/nvss/deaths.htm

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