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National HIV Testing Day — June 27, 2019

National HIV Testing Day, observed each year on June 27, highlights the importance of testing in detecting, treating, and preventing human immunodeficiency virus (HIV) infection. Early diagnosis is critical to controlling HIV transmission in the United States (*1*). With the aim of reducing the number of new infections in the United States by 90% in 10 years, the Ending the HIV Epidemic initiative initially will focus on the 50 local jurisdictions where approximately half of diagnoses made in 2016 and 2017 were concentrated and in seven states with a disproportionate occurrence of HIV in rural areas (*2*). An analysis of 2016 and 2017 population-based survey data reported in this issue of *MMWR* found that overall, 38.9% of the U.S. population had ever tested for HIV infection, including 46.9% in the 50 local jurisdictions with the majority of diagnoses and 35.5% in the seven states with disproportionate occurrence of HIV in rural areas. To control HIV transmission, health care providers and public health practitioners need to develop HIV testing strategies to reach segments of the population that have never tested for HIV infection and offer at least annual testing of persons at risk for infection.

Additional information on National HIV Testing Day is available at https://www.cdc.gov/features/HIVtesting. Basic testing information for the public is available at https://www.cdc.gov/hiv/basics/testing.html. Additional information on HIV testing for health professionals is available at https://www.cdc.gov/hiv/testing. CDC's guidelines for HIV testing of serum and plasma specimens are available at https://www.cdc.gov/hiv/guidelines/testing.html.

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HIV Testing in 50 Local Jurisdictions Accounting for the Majority of New HIV Diagnoses and Seven States with Disproportionate Occurrence of HIV in Rural Areas, 2016–2017

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Since 2006, CDC has recommended universal screening for human immunodeficiency virus (HIV) infection at least once in health care settings and at least annual rescreening of persons at increased risk for infection (*1*,*2*), but data from national surveys and HIV surveillance demonstrate that these recommendations have not been fully implemented (*3*,*4*). The national Ending the HIV Epidemic initiative* is intended to reduce the number of new infections by 90% from 2020 to 2030. The initiative focuses first on 50 local jurisdictions (48 counties, the District of Columbia, and San Juan, Puerto Rico) where the majority of new diagnoses of HIV infection in 2016 and 2017 were concentrated and seven states with a disproportionate occurrence of HIV in rural areas relative to other states (i.e., states with at least 75 reported HIV diagnoses in rural areas that accounted for ≥10% of all diagnoses in the state).† This initial geographic

* https://www.hiv.gov/federal-response/ending-the-hiv-epidemic/overview.

† The 50 local jurisdictions and seven states were identified from diagnoses made during 2016–2017 reported to CDC's National HIV Surveillance System through June 2018. Diagnosis data from 2017 were considered preliminary (https://files.hiv.gov/s3fs-public/ending-the-hiv-epidemic-flyer.pdf). A list of the 50 local jurisdictions and seven states is available in Table 2 of this report and at https://files.hiv.gov/s3fs-public/Ending-the-HIV-Epidemic-Counties-and-Territories.pdf.

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focus will be followed by wider implementation of the initiative within the United States. An important goal of the initiative is the timely identification of all persons with HIV infection as soon as possible after infection (*5*). CDC analyzed data from the Behavioral Risk Factor Surveillance System (BRFSS)[§] to assess the percentage of adults tested for HIV in the United States nationwide (38.9%), in the 50 local jurisdictions (46.9%), and in the seven states (35.5%). Testing percentages varied widely by jurisdiction but were suboptimal and generally low in jurisdictions with low rates of diagnosis of HIV infection. To achieve national goals and end the HIV epidemic in the United States, strategies must be tailored to meet local needs. Novel screening approaches might be needed to reach segments of the population that have never been tested for HIV.

BRFSS is an annual cellular and landline telephone survey of the noninstitutionalized U.S. population aged ≥18 years. The median response rate among all participating states and territories was 47.1% (range = 30.7%–65.0%) in 2016[¶] and 45.9% (range = 30.6%–64.1%) in 2017.[**] Respondents were asked whether they had ever been tested for HIV outside of blood donation; those who answered "yes" were asked for the month and year of their most recent test. Respondents were also asked whether any of the following HIV risk–related situations applied to them in the past year: injected drugs that were not prescribed, received treatment for a sexually transmitted disease, exchanged money or drugs for sex, had anal sex without a condom, or had four or more sex partners. Those who answered "yes" to this question were considered to have reported recent HIV risk.

Data collected in 2016 and 2017 were pooled and used to estimate the percentage and corresponding 95% confidence intervals (CIs) of ever testing for HIV and testing for HIV in the past year overall and for each of the 57 jurisdictions. Nationally and within the seven states with disproportionate rural HIV occurrence, counties were grouped as either mostly urban or mostly or completely rural according to designation by the 2010 U.S. Census.[††] Rao-Scott chi-square tests were used to compare testing percentages between mostly urban and mostly or completely rural areas in the United States and in the seven states with disproportionate rural HIV occurrence. All estimates were weighted to account for the complex multistage sampling design. HIV diagnosis rates per 100,000 population among persons aged ≥13 years were calculated from HIV diagnoses reported to CDC's National HIV Surveillance System during 2016–2017 through December 2018; U.S. Census population estimates for 2016 and 2017 were used for the denominators. HIV diagnosis rates and testing percentages were examined together for each of the 50 local jurisdictions as well as urban and rural areas of the seven states to further characterize these areas with respect to their current HIV

§ https://www.cdc.gov/brfss/index.html.
¶ https://www.cdc.gov/brfss/annual_da101278ta/2016/pdf/2016-sdqr.pdf.
** https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-sdqr-508.pdf.
†† https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html.

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morbidity and testing coverage; Pearson's correlation coefficient was used to assess the correlation between these areas' testing percentages and HIV diagnosis rates. Although BRFSS testing percentages were calculated among those aged ≥18 years, HIV diagnosis rates were calculated among those aged ≥13 years to be consistent with methodology used to identify the jurisdictions accounting for the majority of new HIV diagnoses and because of limited availability of single-year age population estimates at the municipio (county equivalent) level in Puerto Rico. Analyses were performed using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0; RTI International).

During 2016–2017, 38.9% of adults aged ≥18 years in the United States had ever been tested for HIV (Table 1). Among 15,701 (3.2%) persons with reported recent HIV risk for whom at least annual rescreening is recommended, 64.8% were ever tested, and 29.2% were tested in the past year. Among all adults, the percentage ever tested (46.9%) was higher among residents of the 50 local jurisdictions that accounted for the majority of diagnoses of HIV infection among persons aged ≥13 years than was the percentage ever tested (35.5%) in the seven states with disproportionate rural HIV occurrence. Among persons with reported HIV risk, the percentage tested in the past year (34.3%) in the 50 local jurisdictions was also higher than that in the seven states (26.2%). Among all adults in these seven states, 32.1% of those residing in mostly rural areas and 37.2% of those residing in mostly urban areas had ever been tested. Among persons with reported HIV risk in these states, 18.4% of those residing in rural areas and 29.0% of those residing in urban areas were tested in the past year.

Testing percentages varied widely by jurisdiction (Table 2). Among the 50 local jurisdictions, the percentage of persons aged ≥18 years ever tested ranged from 36.5% in Maricopa County, Arizona, to 70.7% in the District of Columbia; the percentage tested in the past year (independent of reported recent HIV risk) ranged from 8.1% in Alameda County, California, to 31.3% in Bronx County, New York. Testing percentages were generally low in both urban and rural areas of the seven states with disproportionate rural HIV occurrence. Among the 50 local jurisdictions and seven states, the percentage of persons aged ≥18 years ever tested for HIV generally increased with increasing HIV diagnosis rate among persons aged ≥13 years (r = 0.71; p<0.01) (Figure). Most of the 50 local jurisdictions had higher testing percentages and diagnosis rates than did the seven states.

Discussion

In this analysis, <40% of the U.S. adult population had ever been tested for HIV. Jurisdictions with the highest rates of diagnosis of HIV infection among persons aged ≥13 years generally had higher testing percentages. The converse was also true. Ever testing for HIV was lower in rural areas of the seven states with disproportionate rural HIV occurrence, compared with that in urban areas of these states, the 50 local jurisdictions with the majority of diagnoses of HIV infection, and the United States nationally. Although past-year HIV testing was higher among persons with reported recent HIV risk than among those without such risk, the percentage tested in the past year was far below the 100% coverage recommended for this group (*1*,*2*). These findings demonstrate missed opportunities

TABLE 1. Ever and past-year testing for human immunodeficiency virus (HIV) among adults aged ≥18 years, by urban-rural classification* — Behavioral Risk Factor Surveillance System, United States, 50 local jurisdictions and seven states,† 2016–2017

Status	Total weighted % (95% CI)	Mostly urban counties weighted % (95% CI)	Mostly or completely rural counties weighted % (95% CI)	p-value§
Ever tested for HIV				
United States	**38.9 (38.7–39.2)**	40.1 (39.8–40.4)	32.0 (31.5–32.4)	<0.001
50 local jurisdictions	**46.9 (46.3–47.5)**	46.9 (46.3–47.5)	N/A	N/A
Seven states	**35.5 (35.0–36.0)**	37.2 (36.6–37.8)	32.1 (31.3–32.9)	<0.001
Tested for HIV in the past year				
United States	**10.1 (9.9–10.2)**	10.6 (10.4–10.8)	6.7 (6.4–7.0)	<0.001
50 local jurisdictions	**14.5 (14.0–14.9)**	14.5 (14.0–14.9)	N/A	N/A
Seven states	**9.3 (8.9–9.6)**	10.1 (9.7–10.5)	7.6 (7.2–8.1)	<0.001
Tested for HIV in the past year among those with reported HIV risk				
United States	**29.2 (27.9–30.6)**	30.2 (28.8–31.8)	20.9 (17.7–24.4)	<0.001
50 local jurisdictions	**34.3 (31.3–37.3)**	34.3 (31.3–37.3)	N/A	N/A
Seven states	**26.2 (23.4–29.3)**	29.0 (25.5–32.8)	18.4 (14.5–23.2)	<0.001

Abbreviations: CI = confidence interval; N/A = not applicable.

* Urban and rural classifications were derived from 2010 U.S. Census. Counties with <50% of the population residing in areas defined as rural were classified as urban counties. Counties with ≥50% of the population residing in areas defined as rural were classified as rural counties.

† The 50 local jurisdictions (48 counties, the District of Columbia, and San Juan, Puerto Rico) accounted for the majority of new HIV diagnoses, and the seven states (Alabama, Arkansas, Kentucky, Mississippi, Missouri, Oklahoma, and South Carolina) experienced disproportionate occurrence of HIV in rural areas, as identified from HIV diagnoses made during 2016–2017 and reported to the National HIV Surveillance System through June 2018. Diagnosis data from 2017 were considered preliminary.

§ Rao-Scott chi-square p-values compare testing estimates between mostly urban counties and mostly or completely rural counties.

TABLE 2. Ever and past-year testing for human immunodeficiency virus (HIV) among adults aged ≥18 years — Behavioral Risk Factor Surveillance System, 50 local jurisdictions and seven states,* 2016–2017

Jurisdiction	No. of respondents†	Ever tested for HIV weighted % (95% CI)	Tested in past year for HIV weighted % (95% CI)
50 local jurisdictions that accounted for the majority of new HIV diagnoses			
Arizona			
Maricopa County	11,130	36.5 (35.1–37.9)	8.4 (7.6–9.3)
California			
Alameda County	740	37.7 (33.3–42.3)	8.1 (5.8–11.2)
Los Angeles County	3,479	43.6 (41.3–45.9)	13.4 (11.9–15.0)
Orange County	1,206	39.8 (36.1–43.6)	10.9 (8.7–13.6)
Riverside County	920	39.6 (35.7–43.7)	10.3 (8.0–13.1)
Sacramento County	952	42.0 (38.1–46.0)	9.1 (7.1–11.7)
San Bernardino County	859	43.0 (38.8–47.2)	12.7 (10.1–15.8)
San Diego County	1,543	45.5 (42.3–48.7)	14.3 (12.1–16.8)
San Francisco County	442	51.8 (45.3–58.3)	14.9 (11.3–19.3)
District of Columbia	**7,125**	**70.7 (69.2–72.1)**	**26.4 (25.0–27.8)**
Florida			
Broward County	923	54.0 (49.4–58.5)	19.0 (15.6–23.0)
Duval County	1,502	57.0 (52.9–61.0)	20.3 (16.7–24.4)
Hillsborough County	1,148	52.7 (48.4–56.9)	15.3 (12.3–18.8)
Miami-Dade County	1,377	56.7 (52.4–60.9)	18.5 (15.2–22.3)
Orange County	1,301	48.6 (44.6–52.7)	14.9 (12.2–18.1)
Palm Beach County	911	45.5 (40.9–50.1)	11.1 (8.4–14.4)
Pinellas County	890	41.0 (36.4–45.8)	12.4 (9.0–16.7)
Georgia			
Cobb County	576	43.7 (38.9–48.7)	10.1 (7.4–13.6)
DeKalb County	603	57.1 (52.2–61.9)	19.5 (15.6–24.0)
Fulton County	967	56.9 (53.2–60.5)	19.7 (16.8–23.1)
Gwinnett County	563	43.2 (38.4–48.2)	11.8 (8.9–15.5)
Illinois			
Cook County	3,807	41.3 (39.3–43.2)	13.5 (12.2–14.9)
Indiana			
Marion County	3,248	45.4 (42.9–47.9)	13.0 (11.2–14.9)
Louisiana			
East Baton Rouge Parish	664	49.7 (44.3–55.2)	17.0 (13.2–21.6)
Orleans Parish	423	58.2 (51.7–64.4)	24.0 (18.2–31.1)
Maryland			
Baltimore City	1,735	62.4 (59.2–65.6)	25.3 (22.3–28.6)
Montgomery County	3,366	44.1 (41.7–46.5)	10.6 (9.2–12.3)
Prince George's County	2,598	56.3 (53.4–59.1)	22.4 (20.1–24.9)
Massachusetts			
Suffolk County	1,495	48.6 (44.7–52.5)	15.2 (12.5–18.2)
Michigan			
Wayne County	2,906	45.3 (43.1–47.5)	14.1 (12.5–15.8)
Nevada			
Clark County	2,770	40.7 (38.5–42.9)	10.9 (9.5–12.4)
New Jersey			
Essex County	1,581	55.0 (51.0–59.0)	17.3 (14.4–20.6)
Hudson County	905	50.2 (45.4–54.9)	15.8 (12.5–19.6)
New York			
Bronx County	1,094	70.0 (66.4–73.4)	31.3 (28.1–34.8)
Kings County	2,030	57.0 (54.3–59.7)	21.6 (19.4–23.9)
New York County	1,782	60.0 (57.0–62.9)	22.0 (19.6–24.6)
Queens County	1,568	52.3 (49.2–55.5)	18.0 (15.7–20.6)
North Carolina			
Mecklenburg County	753	47.1 (42.9–51.3)	13.5 (10.8–16.8)
Ohio			
Cuyahoga County	1,172	44.2 (40.7–47.9)	11.9 (9.6–14.6)
Franklin County	1,749	42.3 (39.4–45.1)	10.1 (8.5–12.1)
Hamilton County	912	41.6 (37.7–45.7)	11.3 (8.9–14.3)
Pennsylvania			
Philadelphia County	1,399	57.5 (54.2–60.7)	21.4 (18.8–24.3)

See table footnotes on next page

TABLE 2. (*Continued*) Ever and past-year testing for human immunodeficiency virus (HIV) among adults aged ≥18 years — Behavioral Risk Factor Surveillance System, 50 local jurisdictions and seven states,* 2016–2017

Jurisdiction	No. of respondents†	Ever tested for HIV weighted % (95% CI)	Tested in past year for HIV weighted % (95% CI)
Puerto Rico			
San Juan Municipio	1,042	57.2 (52.7–61.6)	17.0 (14.0–20.5)
Tennessee			
Shelby County	717	53.4 (49.0–57.8)	22.8 (18.9–27.3)
Texas			
Bexar County	784	45.1 (39.9–50.5)	13.7 (10.2–18.1)
Dallas County	623	44.2 (38.7–49.8)	14.4 (10.7–19.2)
Harris County	1,214	45.9 (41.9–50.0)	13.2 (10.8–16.2)
Tarrant County	740	46.0 (40.8–51.4)	11.6 (8.3–16.0)
Travis County	1,855	50.2 (46.2–54.2)	12.3 (9.9–15.3)
Washington			
King County	6,101	39.4 (37.9–40.9)	8.4 (7.5–9.3)
Seven states with disproportionate HIV occurrence in rural counties			
Alabama, total	**12,098**	**39.4 (38.3–40.6)**	**11.0 (10.2–11.8)**
Urban counties	7,442	40.8 (39.4–42.3)	12.1 (11.1–13.2)
Rural counties	4,656	36.8 (34.8–38.8)	8.8 (7.6–10.2)
Arkansas, total	**9,268**	**33.7 (31.9–35.6)**	**9.1 (7.9–10.4)**
Urban counties	5,206	35.8 (33.4–38.3)	10.6 (8.9–12.5)
Rural counties	4,062	30.9 (28.3–33.6)	7.1 (5.7–8.8)
Kentucky, total	**16,937**	**33.8 (32.6–34.9)**	**7.2 (6.6–7.9)**
Urban counties	8,887	36.3 (34.7–38.0)	8.0 (7.1–9.0)
Rural counties	8,050	29.9 (28.4–31.4)	6.0 (5.3–6.9)
Mississippi, total	**8,984**	**40.2 (38.7–41.7)**	**12.7 (11.6–13.9)**
Urban counties	4,207	44.3 (42.2–46.5)	14.3 (12.7–16.1)
Rural counties	4,777	35.4 (33.4–37.4)	10.9 (9.5–12.4)
Missouri, total	**13,446**	**34.3 (33.1–35.5)**	**8.3 (7.5–9.1)**
Urban counties	9,031	36.4 (34.8–37.9)	9.3 (8.4–10.4)
Rural counties	4,415	29.1 (27.1–31.3)	5.6 (4.5–6.8)
Oklahoma, total	**11,952**	**29.7 (28.6–30.9)**	**6.8 (6.2–7.6)**
Urban counties	7,365	30.7 (29.2–32.2)	7.4 (6.5–8.4)
Rural counties	4,587	27.8 (26.0–29.7)	5.7 (4.8–6.9)
South Carolina, total	**19,983**	**37.4 (36.4–38.3)**	**10.6 (9.9–11.3)**
Urban counties	14,201	37.7 (36.5–38.8)	10.5 (9.8–11.4)
Rural counties	5,782	36.1 (34.3–38.0)	10.9 (9.6–12.4)

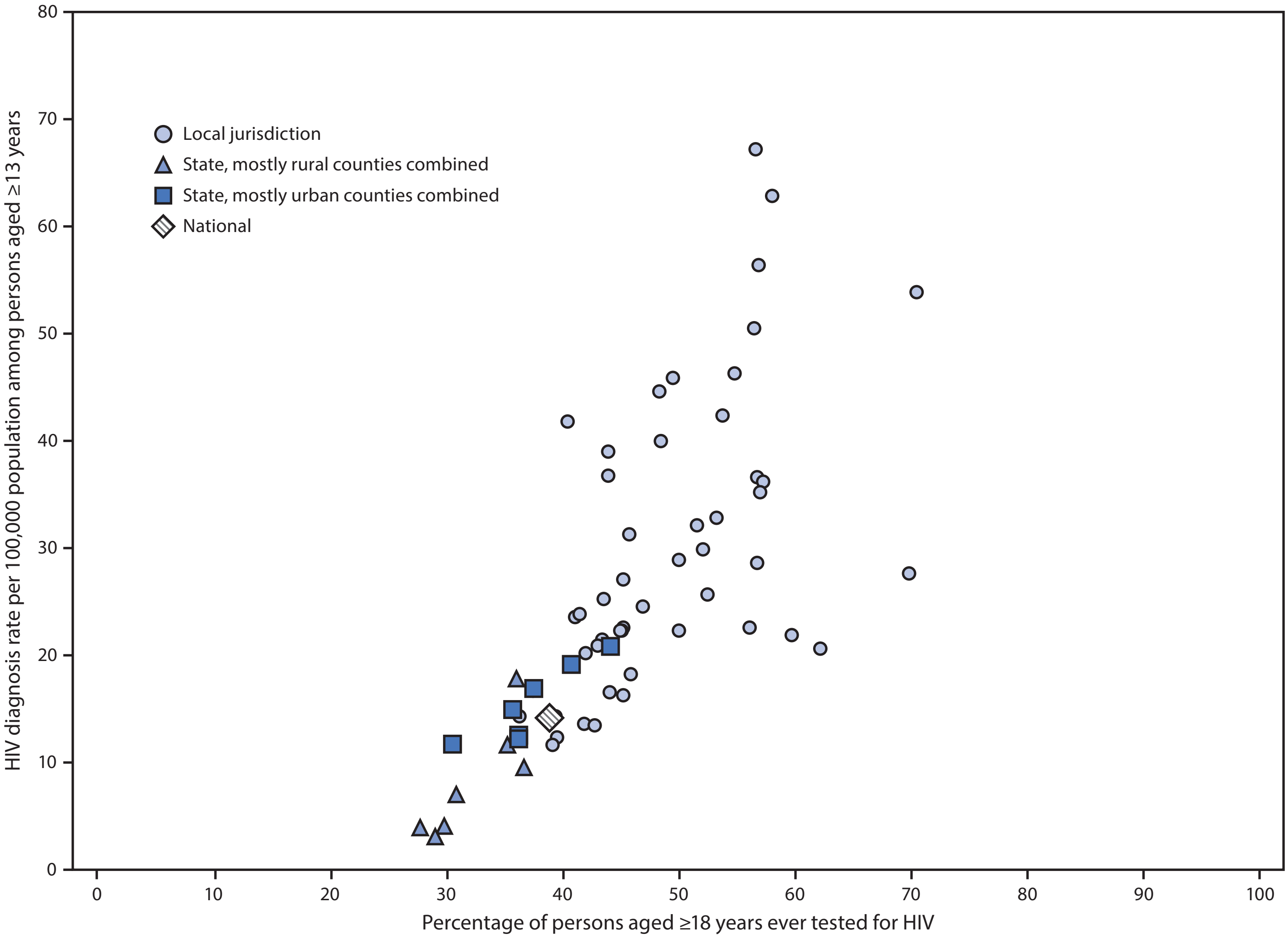
Abbreviation: CI = confidence interval.
* Urban and rural classifications were derived from 2010 U.S. Census. Counties with <50% of the population residing in areas defined as rural were classified as urban counties. Counties with ≥50% of the population residing in areas defined as rural were classified as rural counties. The 50 local jurisdictions (48 counties, the District of Columbia, and San Juan, Puerto Rico) accounted for the majority of new HIV diagnoses, and the seven states (Alabama, Arkansas, Kentucky, Mississippi, Missouri, Oklahoma, and South Carolina) experienced disproportionate occurrence of HIV in rural areas, as identified from HIV diagnoses made during 2016–2017 and reported to the National HIV Surveillance System through June 2018. Diagnosis data from 2017 were considered preliminary.
† Number of respondents with "yes" or "no" response to question about ever testing for HIV.

to fully implement HIV screening recommendations in the 57 jurisdictions that will serve as the initial geographic focus of the Ending the HIV Epidemic initiative. The observed variability in both ever and past-year testing by jurisdiction highlights the need for screening strategies that are tailored to local needs. BRFSS is likely the only annual survey with a sufficient sample size to provide jurisdiction-level estimates of HIV testing to monitor long-term progress toward increasing screening coverage in the United States.

HIV screening strategies will likely need to be locally tailored and novel to reach segments of the population that have not been reached by previous efforts. Examples of novel or promising approaches to increase access to HIV testing include routinizing HIV screening in health care settings, integrating HIV screening with sexual health screenings, scaling up partner notification and other strategies (using social network strategy[§§] or mobile applications) that offer screening of the social and sexual networks of persons seeking HIV screening, promoting pharmacist-led screening[¶¶] as well as screening in other alternative clinical settings such as urgent care, and mass

§§ https://effectiveinterventions.cdc.gov/en/care-medication-adherence/group-4/social-network-strategy-for-hiv-testing-recruitment.
¶¶ https://effectiveinterventions.cdc.gov/en/hiv-testing/group-1/hiv-testing-in-retail-pharmacies.

FIGURE. Percentage of adults aged ≥18 years ever tested for human immunodeficiency virus (HIV) infection and HIV diagnosis rate* among adults and adolescents aged ≥13 years — Behavioral Risk Factor Surveillance System and National HIV Surveillance System (NHSS), 50 local jurisdictions accounting for the majority of new HIV diagnoses and seven states with disproportionate occurrence of HIV in rural areas,† 2016–2017§



* HIV diagnosis rates per 100,000 population among persons aged ≥13 years during 2016–2017 were calculated from HIV diagnoses reported to NHSS through December 2018 and U.S. Census population estimates for 2016 and 2017.

† The 50 local jurisdictions (48 counties, the District of Columbia, and San Juan, Puerto Rico) and seven states (Alabama, Arkansas, Kentucky, Mississippi, Missouri, Oklahoma, and South Carolina) were identified from diagnoses made during 2016–2017 reported to NHSS through June 2018. Diagnosis data from 2017 were considered preliminary.

§ Pearson's correlation coefficient = 0.71; p<0.01.

distribution of HIV self-tests*** (*6–10*). Further efforts will be needed to identify which approaches are most effective in increasing access to HIV testing in various settings and jurisdictions with different baseline needs. Early diagnosis and effective treatment that suppresses HIV replication not only minimize immune system damage and reduce individual morbidity and mortality but also reduce the risk for transmission to others.††† Delayed diagnosis limits these benefits.

HIV screening is a critical entry point to a range of HIV prevention and treatment options. For persons at ongoing risk for HIV infection exposure, annual screening also offers the opportunity to discuss options to reduce risk, including HIV preexposure prophylaxis.§§§

The findings in this report are subject to at least six limitations. First, because the proportion of respondents reporting recent HIV risk was small, testing percentages for this group could not be reported separately in the 57 jurisdictions. Second,

*** https://www.cdc.gov/hiv/testing/hometests.html.

††† https://www.cdc.gov/hiv/risk/art/index.html.

§§§ https://www.cdc.gov/hiv/risk/prep/index.html.

Summary

What is already known about this topic?

Rates of screening for human immunodeficiency virus (HIV) in the United States are low.

What is added by this report?

This analysis of national survey data found that <40% of U.S. adults had ever been tested for HIV, and testing rates varied among jurisdictions comprising the initial focus of the Ending the HIV Epidemic initiative. Within these jurisdictions, rural areas had lower testing percentages and lower HIV diagnosis rates than did urban areas.

What are the implications for public health practice?

Novel HIV screening strategies tailored to meet local needs might be needed to reach segments of the population that have never been tested for HIV and achieve national goals to end the HIV epidemic in the United States.

self-reported data might be subject to social desirability and recall biases, which might have led to over- or underestimation of testing. Third, BRFSS response rates were low; however, the response rates are comparable with those of other national landline and cellular telephone surveys, and survey weights were designed to ensure generalizable findings. Fourth, the measure of HIV-related risk did not include every behavior that might increase risk for HIV infection, such as unprotected sex with a partner who is known to have HIV or whose HIV status is unknown. Fifth, the assessment of HIV diagnosis rates and HIV testing percentages relied on disparate age ranges (≥13 years and ≥18 years, respectively). Finally, this analysis included data from surveys conducted during 2016–2017 and HIV diagnoses that occurred during the same period. These are the most current data available for these measures but represent a delayed cross-section of the current state of HIV testing and diagnoses for 2019. To monitor progress toward national goals, closer to real-time reporting of select HIV testing activities might be needed.

HIV screening remains suboptimal for persons residing in the 57 jurisdictions that will constitute the initial geographic focus of the Ending the HIV Epidemic initiative. These data provide a baseline from which to measure changes in screening in these jurisdictions and other parts of the United States over time. To achieve national goals and end the HIV epidemic in the United States, innovative and novel screening approaches might be needed to reach segments of the population that have never been tested for HIV.

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Cryptosporidiosis Outbreaks — United States, 2009–2017

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Cryptosporidium is a parasite that causes cryptosporidiosis, a profuse, watery diarrhea that can last up to 3 weeks in immunocompetent patients and can lead to life-threatening malnutrition and wasting in immunocompromised patients.* Fecal-oral transmission can occur by ingestion of contaminated recreational water, drinking water, or food, or through contact with infected persons or animals. For the period 2009–2017, public health officials from 40 states and Puerto Rico voluntarily reported 444 cryptosporidiosis outbreaks resulting in 7,465 cases. Exposure to treated recreational water (e.g., in pools and water playgrounds) was associated with 156 (35.1%) outbreaks resulting in 4,232 (56.7%) cases. Other predominant outbreak exposures included contact with cattle (65 outbreaks; 14.6%) and contact with infected persons in child care settings (57; 12.8%). The annual number of reported cryptosporidiosis outbreaks overall increased an average of approximately 13% per year over time. Reversing this trend will require dissemination of prevention messages to discourage swimming or attending child care while ill with diarrhea and encourage hand washing after contact with animals. Prevention and control measures can be optimized by improving understanding of *Cryptosporidium* transmission through regular analysis of systematically collected epidemiologic and molecular characterization data.

A cryptosporidiosis outbreak was defined as two or more cases epidemiologically linked to a common source by location and time of exposure.† Public health officials in the 50 states, the District of Columbia, U.S. territories,§ and Freely Associated States¶ voluntarily report outbreaks to CDC via the National Outbreak Reporting System (NORS). This report summarizes data from outbreak reports submitted to NORS by February 6, 2019, for which at least one etiology was *Cryptosporidium* and earliest illness onset date occurring during 2009 (the first year of NORS reporting) through 2017 (the most recent year for which data were available). NORS outbreak reports include data on etiology; counts of primary cases, hospitalizations, and deaths; transmission mode; exposures and settings; molecular characterization; and earliest illness onset date. Negative binomial regression analyses were conducted to assess trends in annual outbreak counts using SAS (version 9.4; SAS Institute).

For the period 2009–2017, public health officials from 40 states and Puerto Rico voluntarily reported to CDC 444 cryptosporidiosis outbreaks, resulting in 7,465 cases, 287 hospitalizations, and one death (Table). During this period, the eight Great Lake states** reported 254 (57.2%) cryptosporidiosis outbreaks, resulting in 3,335 (44.7%) cases (Figure 1). Exposure to treated recreational water was associated with 156 (35.1%) outbreaks, resulting in 4,232 (56.7%) cases and 183 (63.8%) hospitalizations. The most frequently implicated recreational water venues included pools (100 outbreaks; 64.1%), kiddie/wading pools (11; 7.1%), and water playgrounds (10; 6.4%). Twenty-three (14.7%) outbreaks were associated with multiple recreational water venues (e.g., multiple pools or water playgrounds). Among outbreaks associated with treated recreational water, the median case count was nine (range = 2–638). Among the 288 (64.9%) outbreaks not associated with treated recreational water, the median case count was five (range = 2–205).

Among all 444 outbreaks, 65 (14.6%) were associated with contact with cattle, resulting in 549 cases; 57 (12.8%) were associated with contact with infected persons in child care settings, resulting in 418 cases. Among the 22 foodborne outbreaks, nine (40.9%) were associated with unpasteurized milk and four (18.2%) with unpasteurized apple cider. The mode of transmission was unknown for 63 (14.2%) outbreaks; the predominant settings included private homes/residences (18; 28.6%) and child care (12; 19.0%). Molecular characterization data were available for 67 (15.1%) outbreaks, only one (1.5%) of which had unknown mode of transmission.

Negative binomial regression analysis indicated that during 2009–2017, the overall annual number of reported cryptosporidiosis outbreaks increased an average of 12.8% per year (95% confidence interval [CI] = 7.6%–18.0%) (Figure 2). The annual number of reported treated recreational water–associated outbreaks increased an average of 14.3% (95% CI = 3.4%–25.2%) per year during 2009–2016 ($p = 0.010$); however, because of a decline in reported outbreaks in 2017, no trend was found for the annual number of treated recreational water–associated outbreaks during 2009–2017 ($p = 0.293$).

* https://www.cdc.gov/parasites/crypto/index.html.
† https://www.cdc.gov/nors/forms.html.
§ American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands.
¶ Federated States of Micronesia, Marshall Islands, and Palau.

** Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin.

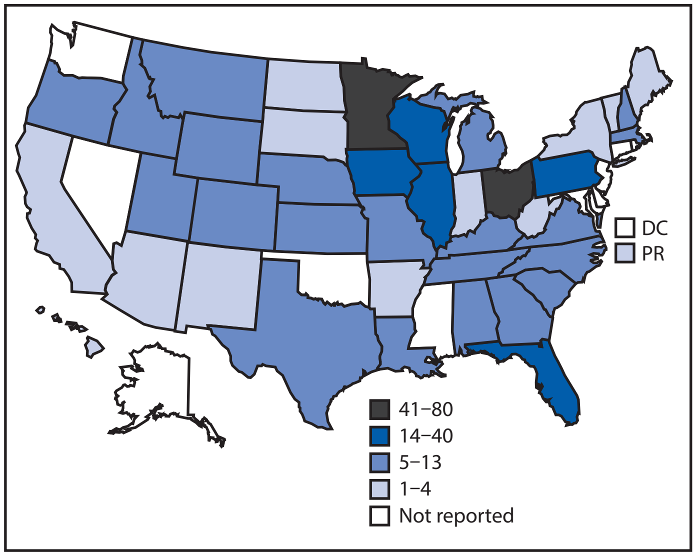
TABLE. Cryptosporidiosis outbreaks (N = 444), cases, and hospitalizations, by mode of transmission and exposure — 40 states and Puerto Rico, 2009–2017

	No. (%)		
Transmission mode	**Outbreaks**	**Cases**	**Hospitalizations**
All modes	**444 (100)**	**7,465 (100)**	**287 (100)**
Waterborne, exposure source	**183 (41.2)**	**5,015 (67.2)**	**194 (67.6)**
Recreational water			
Treated (e.g., pool)	156	4,232	183
Untreated (e.g., lake)	14	263	3
Drinking water	8	339	3
Other*	5	181	5
Person-to-person, exposure setting	**88 (19.8)**	**754 (10.1)**	**24 (8.4)**
Child day care	57	418	11
Private home/Residence	15	66	5
Long-term care/Assisted living facility	2	148	0
School/College/University	2	18	1
Other†	8	85	6
Undetermined§	4	19	1
Animal contact, reservoir	**86 (19.4)**	**788 (10.6)**	**34 (11.8)**
Cattle	65	549	19
Goats	9	99	7
Sheep	1	5	0
Multiple species	4	105	6
Undetermined§	7	30	2
Foodborne, vehicle	**22 (5.0)**	**283 (3.8)**	**11 (3.8)**
Milk, unpasteurized	9	52	4
Apple cider, unpasteurized	4	36	1
Fresh produce¶	2	14	1
Undetermined§	7	181	5
Environmental contamination**	**2 (0.5)**	**9 (0.1)**	**1 (0.3)**
Unknown††	**63 (14.2)**	**616 (8.3)**	**23 (8.0)**

* Waterborne outbreaks were categorized as other if the outbreak was associated with environmental exposures to water (i.e., water from a source other than a recreational venue or drinking water system) or with undetermined exposures to water (i.e., evidence to implicate a single type of water exposure was insufficient).
† Person-to-person outbreaks categorized as other involved the following settings: camp (one), festival/fair (one), hospital (one), hotel/motel (one), and other unspecified (four). The person-to-person outbreak associated with a hospital setting resulted in one reported death.
§ Outbreaks were categorized as undetermined if mode of transmission was identified but specific water exposure, setting of person-to-person exposure, animal reservoir, food vehicle, or fomite was not identified or reported.
¶ One fresh produce–associated foodborne outbreak was associated with strawberries, the other with kale.
** Outbreaks were categorized as environmental cryptosporidiosis outbreaks if *Cryptosporidium* was transmitted through contact with fomites, such as dirty linens or high-touch bathroom surfaces.
†† Outbreaks were categorized as having an unknown transmission mode if evidence to implicate one specific primary mode of transmission was insufficient.

During 2009–2017, the annual number of reported outbreaks associated with contact with cattle increased an average of 20.3% (95% CI = 9.2%–31.4%) per year, and the annual number of reported outbreaks associated with contact with infected persons in child care settings increased an average of 19.7% (95% CI = 8.8%–30.5%) per year. During 2009–2017, the overall number of reported cryptosporidiosis outbreaks by month peaked during July–August, the number associated with treated recreational water peaked in June–August, the number associated with cattle contact peaked during March–May, and those associated with contact with infected persons in child care settings peaked during July–September (Figure 2).

FIGURE 1. Reported cryptosporidiosis outbreaks (N = 444), by exposure jurisdiction* — United States, 2009–2017†



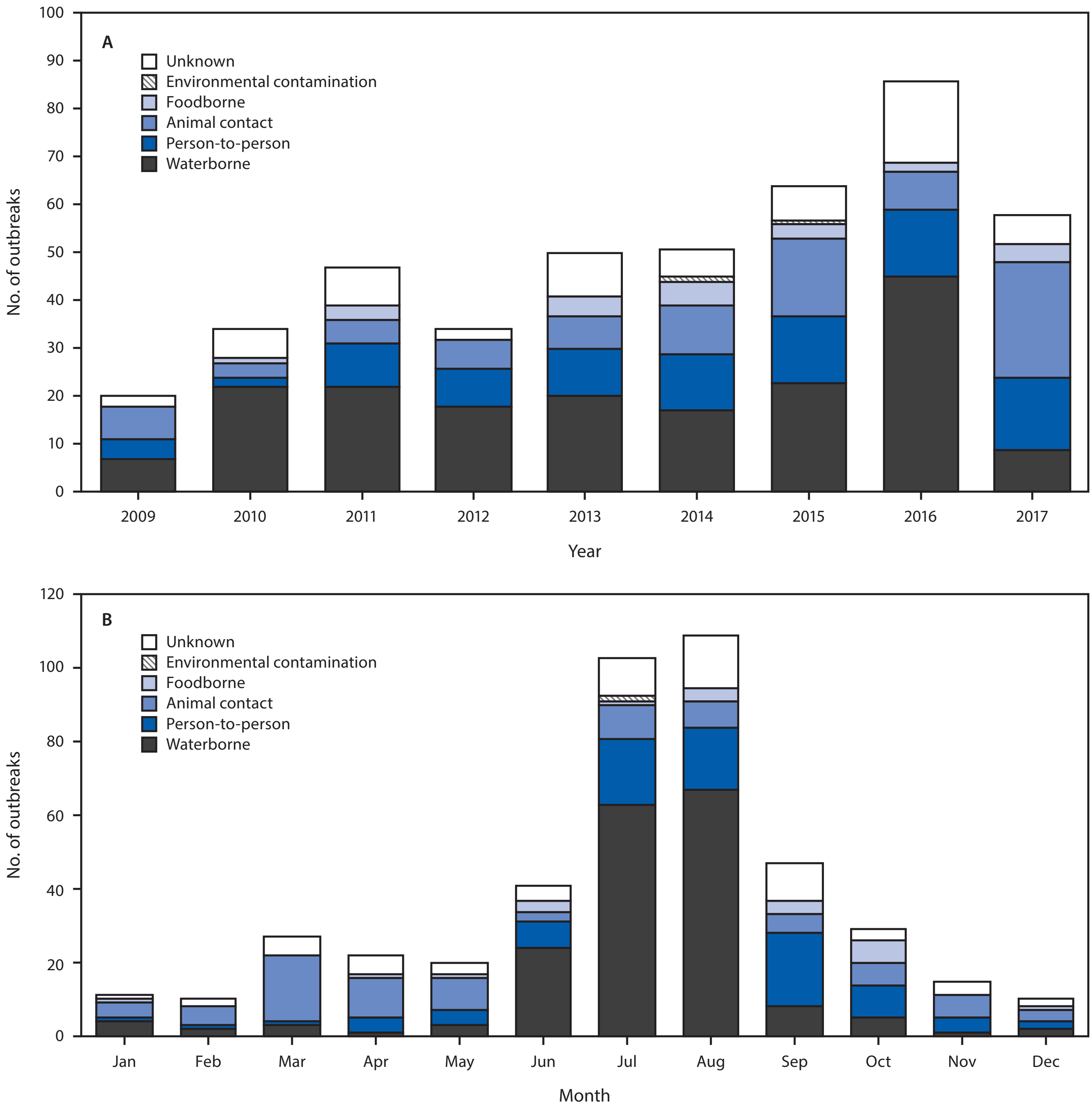
Abbreviations: DC = District of Columbia; PR = Puerto Rico
* Exposure juridictions are all states, DC, and PR.
† These numbers are largely dependent on reporting requirements and public health capacity, which vary across jurisdictions and do not necessarily indicate the actual occurrence of cryptosporidiosis outbreaks in a given jurisdiction.

Discussion

The 444 outbreaks characterized in this report highlight the public health importance of *Cryptosporidium,* which is the leading etiology of waterborne outbreaks (*1*) and the third leading etiology of enteric infections attributable to animal contact (*2*) in the United States. In part, this is because *Cryptosporidium* oocysts are immediately infectious upon excretion, are excreted in numbers multiple orders of magnitude higher than the human infectious dose (≤10 oocysts), and are extremely tolerant to chlorine. These factors should be considered in the development of effective cryptosporidiosis prevention measures.

The number of treated recreational water–associated outbreaks caused by *Cryptosporidium* drives the summer seasonal peak in both waterborne cryptosporidiosis outbreaks and cryptosporidiosis outbreaks overall. A treated recreational water–associated cryptosporidiosis outbreak can result in hundreds or thousands of cases, because 1) an infected swimmer can excrete 10^7–10^8 oocysts in one diarrheal incident in the water (*3*); 2) *Cryptosporidium* oocysts can survive >7 days at

FIGURE 2. Reported cryptosporidiosis outbreaks (N = 444), by mode of transmission* and year of earliest illness onset date (A) and month of earliest illness onset date (B) — United States, 2009–2017



* Transmission modes were categorized as follows: *Unknown* if insufficient evidence to implicate one specific primary mode of transmission; *Environmental contamination* if transmitted through exposure to a contaminated environment not attributable to foodborne, waterborne, person-to-person, or animal contact transmission; *Foodborne* if transmitted by consumption of contaminated food or non-water beverages; *Animal contact* if transmitted through contact with animals or their living environments; *Person-to-person* if transmission occurred from direct contact with an infected person, their bodily fluids, or by contact with the local environment where the exposed person was simultaneously present; and *Waterborne* if transmission occurred via ingestion, inhalation, contact, or another exposure to water (e.g., treated or untreated recreational water, drinking water [including bottled water], or an environmental or indeterminate water source). https://www.cdc.gov/nors/forms.html.

CDC-recommended concentrations of >1 ppm free available chlorine (*4*); and 3) swimmers might use multiple recreational water venues.

The summer seasonal peak of cryptosporidiosis outbreaks associated with child care is similar to that of treated recreational water–associated outbreaks. Contributing factors include 1) cryptosporidiosis disproportionately affects children aged 1–4 years (*5*); 2) young children, who have no or limited toileting skills and who ingest recreational water, often use one or more kiddie/wading pools, water playgrounds, and other treated recreational water venues; and 3) chlorine (or bleach) is the primary barrier to pathogen transmission in child care facilities. Consequently, community-wide cryptosporidiosis outbreaks, in which an outbreak associated with a single treated recreational water venue evolves into one associated with multiple venues and settings (e.g., child care facilities), have been documented (*6*). Thus, primary prevention of *Cryptosporidium* contamination is important. CDC recommends not swimming or attending child care if ill with diarrhea and not swimming for an additional 2 weeks after diarrhea has resolved.[††] If a cryptosporidiosis outbreak occurs, substantial decontamination measures are needed, including hyperchlorinating[§§] public treated recreational water venues (e.g., at a hotel, apartment complex, or waterpark) and using hydrogen peroxide[¶¶] to disinfect surfaces in child care settings to inactivate *Cryptosporidium* oocysts.

Cryptosporidium contamination can be unavoidable and widespread in environments where ruminants such as cattle, goats, and sheep live. *Cryptosporidium* transmission from preweaned calves to humans has been well documented, and the spring seasonal peak in outbreaks associated with contact with cattle coincides with the spring calving season (*7*). Bovine calves can shed $>10^{10}$ oocysts daily (*8*). To minimize further contamination and risk for infection, CDC recommends hand washing[***] after coming in direct or indirect contact with ruminants or their living environments. Additional preventive measures include, but are not limited to, removing clothing and shoes worn in the animals' living environment before entering other environments (e.g., a home) to reduce risk for cross-contamination.

Cryptosporidium caused 13 outbreaks associated with unpasteurized milk or apple cider during 2009–2017. Outbreak sources might include contaminated udders, apples, or processing equipment. CDC recommends consumption of pasteurized milk and apple cider because of the risk for infection from unpasteurized products in general and the risk for severe illness in young children, pregnant women, and immunocompromised persons.[†††]

The findings in this report are subject to at least five limitations. First, the outbreaks described in this report likely underestimate the actual number of cryptosporidiosis outbreaks, and the reported number of cases likely underestimate the actual magnitude of individual outbreaks. Second, the advent of multipathogen molecular testing panels, which include *Cryptosporidium*, could have contributed to the increase in reported outbreaks in recent years. Third, requirements and capacity to detect, investigate, and report outbreaks vary across jurisdictions. Thus, it is unclear if approximately half of the outbreaks actually occurred in the Great Lakes states; further investigation is warranted. Fourth, only two outbreaks were determined to be the result of transmission by environmental contamination; this might be because of difficulties inherent to implicating fomites as an outbreak source. Finally, only 67 NORS outbreak reports included molecular characterization data, precluding analysis of mode of transmission by *Cryptosporidium* species and genotypes.

Summary

What is already known about this topic?

Cryptosporidium is the leading cause of outbreaks of diarrhea linked to water and the third leading cause of diarrhea associated with animal contact in the United States.

What is added by this report?

During 2009–2017, 444 cryptosporidiosis outbreaks, resulting in 7,465 cases were reported by 40 states and Puerto Rico. The number of reported outbreaks has increased an average of approximately 13% per year. Leading causes include swallowing contaminated water in pools or water playgrounds, contact with infected cattle, and contact with infected persons in child care settings.

What are the implications for public health practice?

To prevent cryptosporidiosis outbreaks, CDC recommends not swimming or attending child care if ill with diarrhea and recommends hand washing after contact with animals.

[††] https://www.cdc.gov/parasites/crypto/childcare/prevent.html; https://www.cdc.gov/healthywater/swimming/swimmers/steps-healthy-swimming.html.

[§§] At water pH ≤7.5 and temperature ≥77°F (25°C), 2- to 3-log10 (99%–99.9%) *Cryptosporidium* inactivation can be achieved by raising the free available chlorine concentration for a prolonged period (https://www.cdc.gov/healthywater/swimming/pdf/fecal-incident-response-guidelines.pdf). CDC does not recommend hyperchlorinating residential venues (e.g., those in a backyard).

[¶¶] Do not mix hydrogen peroxide and bleach solutions; the two can react violently. If the health department instructs a child care facility to disinfect surfaces with both a bleach solution and hydrogen peroxide, facility personnel should first clean the surface and then disinfect it with the bleach solution, thoroughly rinse it with water, soak it with hydrogen peroxide for 20 minutes, and thoroughly rinse it with water. https://www.cdc.gov/parasites/crypto/childcare/outbreak.html.

[***] Alcohol-based hand sanitizers do not effectively inactivate *Cryptosporidium*. Furthermore, hand sanitizers might not effectively inactivate pathogens, in general, when hands are visibly dirty or greasy. https://www.cdc.gov/handwashing/index.html.

[†††] https://www.cdc.gov/foodsafety/rawmilk/raw-milk-index.html.

Reversing the increasing trends in annual numbers of reported cryptosporidiosis outbreaks overall and those associated with treated recreational water, contact with cattle, or contact with infected persons in child care settings will require implementing effective prevention measures.[§§§] Approximately 40 *Cryptosporidium* species have been identified to date, of which 17 species and four additional genotypes have been reported to infect humans (*9*). Most *Cryptosporidium* species and genotypes cannot be distinguished by traditional diagnostic tests (microscopy or immunoassays). Therefore, advancing molecular characterization methods, such as those used by CryptoNet, the first U.S. molecularly based surveillance system for a parasitic disease, might help optimize efforts to prevent cryptosporidiosis. Given that individual species, genotypes, and subtypes can have unique host ranges, molecular characterization can provide insight into outbreak exposures and sources. CryptoNet has already demonstrated its ability to elucidate *Cryptosporidium* transmission chains when used in investigations of treated recreational water–associated outbreaks (*10*) and has the potential to do the same for investigations of cryptosporidiosis outbreaks not associated with treated recreational water.

[§§§] https://www.cdc.gov/parasites/crypto/gen_info/prevention-general-public.html.

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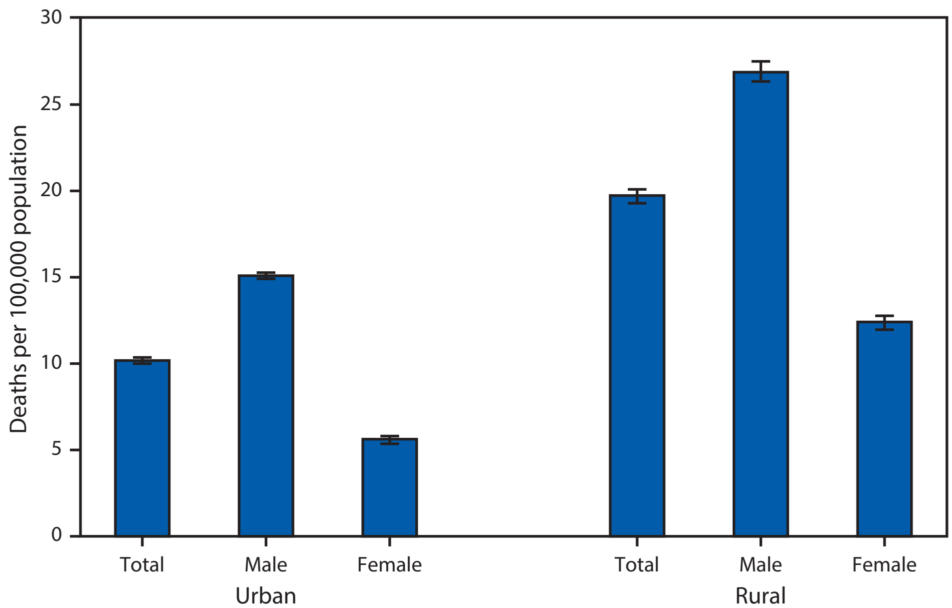
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Motor Vehicle Traffic Death Rates,*,† by Urban-Rural Status§ and Sex — National Vital Statistics System, United States, 2017



* Data were age-adjusted to the 2000 U.S. standard population.

† Motor vehicle traffic deaths were selected using the *International Classification of Diseases, Tenth Revision* (ICD-10) underlying cause-of-death codes V02–V04 (.1, .9), V09.2, V12–V14 (.3–.9), V19 (.4–.6), V20–V28 (.3–.9), V29–V79 (.4–.9), V80 (.3–.5), V81.1, V82.1, V83–V86 (.0–.3), V87 (.0–.8), and V89.2. All motor vehicle traffic deaths were unintentional. Decedents included motor vehicle occupants, motorcyclists, pedal cyclists, and pedestrians.

§ Urban-rural status is classified in accordance with the National Center for Health Statistics 2013 Urban-Rural Classification Scheme.

In 2017, the age-adjusted rate of motor vehicle traffic deaths was higher for residents of rural areas (19.7 per 100,000) than urban areas (10.2). Rates were higher in rural compared with urban areas for both female and male residents, and rates for males were higher than for females in both urban and rural areas. The death rates were 12.6 per 100,000 for female residents of rural areas, 5.6 for female residents of urban areas, 26.9 for male residents of rural areas, and 15.1 for male residents of urban areas.

Sources: National Center for Health Statistics, National Vital Statistics System, Mortality File. https://www.cdc.gov/nchs/nvss/deaths.htm. Ingram DD, Franco SJ. 2013 National Center for Health Statistics urban-rural classification scheme for counties. Vital Health Stat 2014;2(166). https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

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For more information on this topic, CDC recommends the following link: https://www.cdc.gov/motorvehiclesafety/calculator/index.html.

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