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Active Epilepsy and Seizure Control in Adults — United States, 2013 and 2015

Niu Tian, MD, PhD[1]; Michael Boring, MS[1,2]; Rosemarie Kobau, MPH[1]; Matthew M. Zack, MD[1]; Janet B. Croft, PhD[1]

Approximately 3 million American adults reported active epilepsy* in 2015 (*1*). Active epilepsy, especially when seizures are uncontrolled, poses substantial burdens because of somatic, neurologic, and mental health comorbidity; cognitive and physical dysfunction; side effects of antiseizure medications; higher injury and mortality rates; poorer quality of life; and increased financial cost (*2*). Thus, prompt diagnosis and seizure control (i.e., seizure-free in the 12 months preceding the survey) confers numerous clinical and social advantages to persons with active epilepsy. To obtain recent and reliable estimates of active epilepsy and seizure control status in the U.S. population, CDC analyzed aggregated data from the 2013 and the 2015 National Health Interview Surveys (NHISs). Overall, an annual estimated 2.6 million (1.1%) U.S. adults self-reported having active epilepsy, 67% of whom had seen a neurologist or an epilepsy specialist in the past year, and 90% of whom reported taking epilepsy medication. Among those taking epilepsy medication, only 44% reported having their seizures controlled. A higher prevalence of active epilepsy and poorer seizure control were associated with low family income, unemployment, and being divorced, separated, or widowed. Use of epilepsy medication was higher among adults who saw an epilepsy specialist in the past year than among those who did not. Health care and public health should ensure that adults with uncontrolled seizures have appropriate care and self-management support in order to promote seizure control, improve health and social outcomes, and reduce health care costs.

NHIS is an annual, nationally representative household survey of the U.S. civilian, noninstitutionalized population.† Epilepsy data were collected in the NHIS Sample Adult component, which includes one randomly selected adult aged ≥18 years from each randomly selected household. In 2013, 34,557 adults (61.2% final response rate) responded to the survey, and in 2015, 33,672 adults (55.2% final response rate) responded.§ Data for 2013 and 2015 were aggregated to provide more reliable estimates (58.2% combined response rate). After excluding respondents with missing information on epilepsy history, 68,174 (99.9%) respondents were included in the analysis.

*Among those reporting that a doctor or health professional had told them they had a seizure disorder or epilepsy, those who reported taking medication, having had one or more seizures in the past year, or both were considered to have active epilepsy.

†https://www.cdc.gov/nchs/nhis/index.htm.

§https://www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm.

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Adult respondents answered three questions about epilepsy to identify persons with active epilepsy and one question regarding specialty care.¶ These case-ascertainment questions have been validated for use in community surveillance (*3*). Prevalence of active epilepsy and percentages of respondents with epilepsy who had seen a neurologist or epilepsy specialist in the past year, who were taking epilepsy medication, and whose seizures were controlled (i.e., had no seizures during the past year) among those taking epilepsy medication were estimated for each survey year, both survey years, overall, and by selected sociodemographic characteristics. The percentages of adults taking epilepsy medication and the distribution of seizure frequencies among those with active epilepsy by epilepsy specialty care were also estimated. Prevalences and percentages were age-standardized to the projected 2000 U.S. adult population by four age groups: 18–34, 35–54, 55–64, and ≥65 years. Unless otherwise noted, the relative standard error of all estimates was <30.0%. Statistical software that accounted for the respondent sampling weights and the NHIS complex sample design was used for analysis. All reported differences between subgroups were statistically significant ($p<0.05$ by two-tailed t-tests).

¶ 1) "Have you ever been told by a doctor or other health professional that you have a seizure disorder or epilepsy?" 2) "Are you currently taking any medicine to control your seizure disorder or epilepsy?" 3) "Think back to last year about the same time. About how many seizures of any type have you had in the past year?" and 4) "In the past year have you seen a neurologist or epilepsy specialist for your epilepsy or seizure disorder?"

Summary

What is already known about this topic?

Approximately 3 million American adults have active epilepsy (doctor-diagnosed history of epilepsy, currently taking medication or having at least one seizure in the past year, or both). Uncontrolled seizures harm health, impair quality of life, and increase health care costs.

What is added by this report?

Although 90% of adults with active epilepsy were taking epilepsy medication, less than half (44%) of those taking medications were seizure-free in the past year. Seizures were more common among persons with lower household income, the unemployed, and the divorced, separated, or widowed.

What are the implications for public health practice?

Health care and public health should ensure that adults with uncontrolled seizures have appropriate care and self-management support in order to promote seizure control, improve health and social outcomes, and reduce health care costs.

During 2013 and 2015, the annual prevalence of active epilepsy was 1.1% (approximately 2.6 million adults) and was significantly higher in 2015 (1.2%) than in 2013 (0.9%). The age-adjusted prevalence of active epilepsy was significantly higher among respondents who were non-Hispanic white (white) and non-Hispanic black (black); never married, divorced, separated, or widowed; had less than high school diploma; were unemployed, or living in lower-income families

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(e.g., families earning <200% of federal poverty level [FPL]) than among other groups (Table).

The percentage of respondents with active epilepsy who had seen a neurologist or an epilepsy specialist in the past year was 67%. This percentage was significantly higher among respondents aged 18–34 years, with at least some college education, or who lived in the Northeast than that among respondents aged ≥55 years, who had less than a high school education, or who lived in other regions.

Ninety percent of respondents with active epilepsy took epilepsy medication, and this percentage did not significantly differ by sociodemographic characteristics. Among respondents taking epilepsy medication, 44% reported that their seizures were controlled in the past year. The prevalence of seizure control was significantly higher among adults aged ≥65 years (62.7%) than among those aged 35–54 years (36.9%); among persons who were married/cohabiting (50.0%) than among those who were divorced, separated, or widowed (31.5%); among persons who were employed (54.3%) than among those who were unemployed (37.7%); and among those with higher family incomes (≥200% of FPL; 55.3%) than among those from lower income households (<200% of FPL; 33.2%). By region, the prevalence of seizure control among respondents with epilepsy taking epilepsy medication who lived in the Northeast (60.3%) was significantly higher than those who lived in the South (37.5%).

TABLE. Number and age-adjusted* prevalence of active epilepsy, and percentages of adults who accessed specialty care, took epilepsy medications for seizure control, and were seizure-free with epilepsy medication in the past year among doctor-diagnosed active epilepsy,† by selected characteristics — National Health Interview Survey, United States, 2013 and 2015

	Adults with active epilepsy			Seen a neurologist or epilepsy specialist			Taking epilepsy medication to control seizure			Seizure-free with epilepsy medication		
Characteristic	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)
Survey year												
2013	367	2,254,000	0.9 (0.8–1.1)	217	1,428,000	65.7 (59.1–71.8)	305	1,948,000	86.3 (81.1–90.3)	136	871,000	45.3 (37.3–53.6)
2015	401	2,978,000	1.2 (1.1–1.4)	255	2,032,000	68.3 (62.1–74.0)	352	2,749,000	93.0 (89.8–95.3)	152	1,184,000	42.4 (35.0–50.2)
Total (crude)	**768**	**2,616,000**	**1.1 (1.0–1.2)**	**472**	**1,730,000**	**66.2 (61.6–70.5)**	**657**	**2,348,000**	**90.2 (87.4–92.4)**	**288**	**1,028,000**	**44.1 (38.7–49.7)**
Total (age-adjusted)	**768**	**2,616,000**	**1.1 (1.0–1.2)**	**472**	**1,730,000**	**67.0 (62.6–71.2)**	**657**	**2,348,000**	**90.2 (87.4–92.4)**	**288**	**1,028,000**	**43.7 (38.1–49.5)**
Sex												
Men	354	1,327,000	1.1 (1.0–1.3)	224	919,000	69.7 (62.9–75.7)	313	1,221,000	92.0 (87.5–95.0)	146	538,000	43.7 (36.1–51.5)
Women	414	1,289,000	1.0 (0.9–1.2)	248	811,000	64.5 (58.4–70.1)	344	1,128,000	88.3 (84.2–91.4)	142	490,000	43.5 (35.7–51.6)
Age group (yrs)												
18–34	165	803,000	1.1 (0.9–1.4)	116	615,000	76.7 (67.8–83.7)	136	721,000	91.0 (85.8–94.4)	54	303,000	42.3 (30.9–54.5)
35–54	280	867,000	1.0 (0.9–1.2)	175	585,000	67.5 (59.9–74.2)	235	768,000	88.6 (83.1–92.4)	80	280,000	36.9 (28.5–46.1)
55–64	165	540,000	1.4 (1.1–1.6)	95	305,000	56.5 (46.5–66.1)	144	483,000	89.4 (82.9–93.6)	63	209,000	43.7 (33.5–54.5)
>65	158	404,000	0.9 (0.7–1.1)	86	225,000	55.6 (45.0–65.7)	142	377,000	93.1 (88.0–96.1)	91	236,000	62.7 (50.7–73.3)
Race/Ethnicity												
White, non-Hispanic	507	1,857,000	1.2 (1.0–1.3)	306	1,246,000	67.9 (62.6–72.8)	440	1,692,000	91.4 (88.0–93.9)	216	811,000	47.5 (40.4–54.6)
Black, non-Hispanic	136	401,000	1.4 (1.1–1.7)	84	233,000	62.8 (50.6–73.7)	114	348,000	88.8 (81.0–93.6)	35	104,000	32.3 (21.5–45.3)
Other	125	357,000	0.7 (0.6–0.9)	82	251,000	70.5 (59.4–79.6)	103	309,000	86.5 (78.8–91.8)	37	113,000	37.3 (26.7–49.3)
Marital status												
Never married	246	934,000	2.0 (1.6–2.3)	165	691,000	71.0 (62.5–78.2)	219	862,000	92.7 (87.6–95.8)	87	351,000	44.9 (35.3–55.0)
Married/ Cohabitating	255	1,036,000	0.7 (0.6–0.8)	156	667,000	64.5 (56.4–71.9)	218	932,000	88.3 (82.5–92.3)	106	441,000	50.0 (41.5–58.5)
Divorced/ Separated/ Widowed	266	641,000	1.7 (1.2–2.3)	150	367,000	63.9 (53.4–73.2)	219	550,000	85.8 (76.6–91.8)	95	236,000	31.5 (25.3–38.4)

See table footnotes on the next page.

TABLE. (*Continued*) Number and age-adjusted* prevalence of active epilepsy, and percentages of adults who accessed specialty care, took epilepsy medications for seizure control, and were seizure-free with epilepsy medication in the past year among doctor-diagnosed active epilepsy,† by selected characteristics — National Health Interview Survey, United States, 2013 and 2015

Characteristic	Adults with active epilepsy			Seen a neurologist or epilepsy specialist			Taking epilepsy medication to control seizure			Seizure-free with epilepsy medication		
	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)	No.	No. (weighted)§	Age-adjusted % (95% CI)
Education level												
Less than HS	194	564,000	1.8 (1.5–2.2)	104	310,000	58.7 (48.9–67.9)	164	498,000	89.4 (82.9–93.6)	63	192,000	39.0 (28.9–50.2)
HS diploma or GED	216	803,000	1.3 (1.1–1.6)	131	496,000	62.4 (53.5–70.5)	190	733,000	92.5 (88.0–95.4)	76	283,000	38.9 (30.2–48.4)
Some college	348	1,203,000	0.8 (0.7–0.9)	231	896,000	74.2 (67.8–79.8)	294	1,074,000	89.0 (84.3–92.4)	144	533,000	49.4 (41.3–57.6)
Current employment												
Yes	215	783,000	0.5 (0.4–0.6)	129	538,000	67.9 (59.4–75.5)	183	709,000	89.6 (83.8–93.5)	104	376,000	54.3 (44.1–64.1)
No	553	1,833,000	2.5 (2.2–2.8)	343	1,192,000	67.9 (62.6–72.7)	474	1,639,000	90.1 (86.7–92.8)	184	652,000	37.7 (31.0–45.1)
Poverty status**												
<200% of FPL	481	1,383,000	1.9 (1.6–2.1)	284	864,000	64.6 (58.4–70.4)	402	1,222,000	88.2 (84.0–91.4)	143	399,000	33.2 (26.6–40.4)
≥200% of FPL	287	1,233,000	0.8 (0.6–0.9)	188	866,000	70.6 (63.4–76.9)	255	1,126,000	92.1 (87.9–94.9)	145	628,000	55.3 (46.7–63.6)
Region††												
Northeast	112	390,000	0.9 (0.7–1.2)	82	316,000	84.3 (74.9–90.7)	97	358,000	89.5 (79.7–94.9)	46	209,000	60.3 (47.1–72.1)
Midwest	157	549,000	1.0 (0.8–1.2)	94	349,000	63.9 (54.8–72.2)	136	491,000	90.1 (83.3–94.4)	67	233,000	47.9 (36.5–59.5)
South	291	1,096,000	1.2 (1.1–1.4)	177	706,000	66.7 (59.9–72.9)	251	977,000	90.3 (85.2–93.7)	98	374,000	37.5 (29.3–46.3)
West	208	580,000	1.0 (0.8–1.3)	119	359,000	61.5 (51.8–70.4)	173	522,000	89.3 (84.0–93.0)	77	212,000	41.4 (31.0–52.5)

Abbreviations: CI = confidence interval; GED = General Educational Development; HS = high school; FPL = federal poverty level.

* Age-adjusted to the 2000 U.S. projected population, aged ≥18 years, using four age groups: 18–34, 35–54, 55–64, and ≥65 years. All prevalence estimates are age-adjusted except those for age groups, and overall (crude).

† Doctor-diagnosed active epilepsy was defined as having a diagnosis of epilepsy and either taking medication or having had one or more seizures in the past year, or both.

§ Annualized and weighted number rounded to 1,000s.

¶ Other race/ethnicity includes non-Hispanic American Indian and Alaska Native only; non-Hispanic Asian only; non-Hispanic Native Hawaiian and Pacific Islander only; and non-Hispanic multiple race.

** Poverty status was defined as the ratio of family income to FPL.

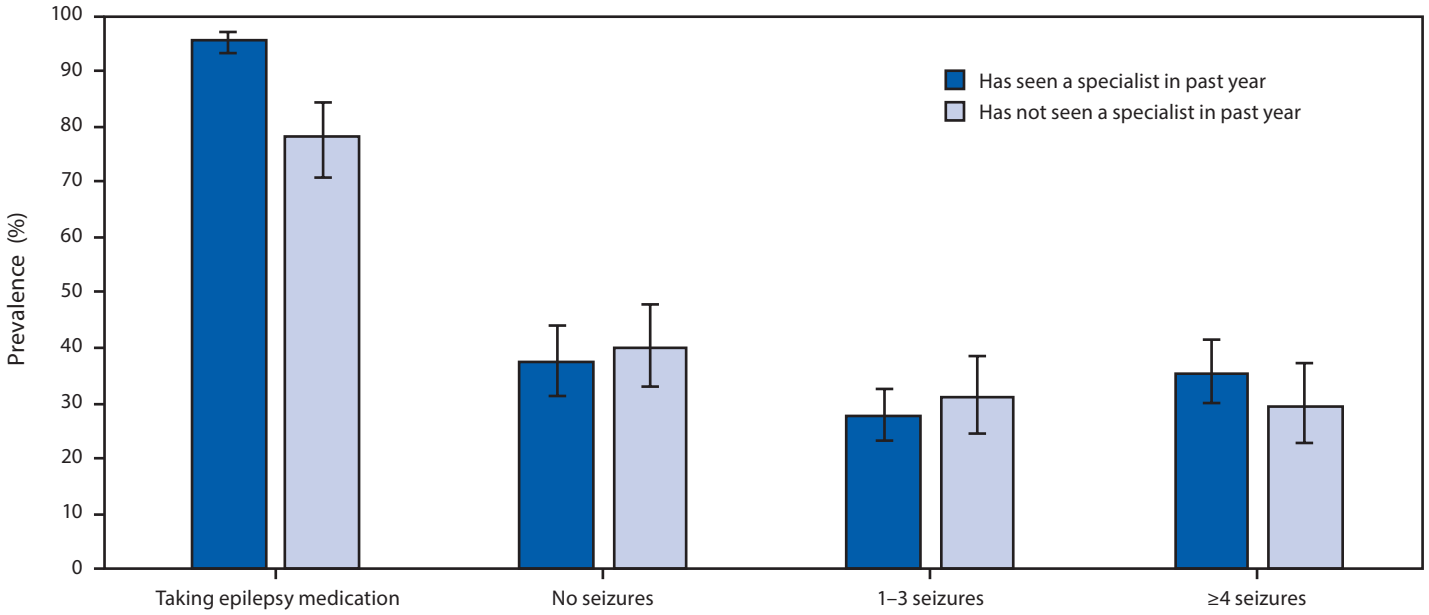
†† Northeast region (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); Midwest region (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); South region (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Mississippi, Maryland, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); West region (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming).

Among adults with active epilepsy, the age-adjusted prevalence of taking epilepsy medication was higher among those who saw an epilepsy specialist in the past year (95.4%) than among those who did not (78.1%); however, seizure frequency among those with active epilepsy did not differ significantly between those who did and did not see a specialist in the past year (Figure).

Discussion

The number of adults reporting that they have active epilepsy has significantly increased from 2010 (2.3 million) (*4*) to 2015 (3 million), with about 724,000 more cases identified from 2013 to 2015. In 2010, just over half (52.8%) of adults with active epilepsy saw a neurologist or epilepsy specialist (*4*). This study found that approximately two thirds (65.7% in 2013 and 68.3% in 2015) of adults with epilepsy saw a specialist. Most (90%) respondents with active epilepsy were taking epilepsy medication. Epilepsy medication use, but not reduced seizure frequency, was more common among those who had seen an epilepsy specialist; however, only 44% of respondents who took epilepsy medication had their seizures controlled in the past year. These results suggest that apart from the improvement associated with prompt diagnosis and treatment, other factors that might affect seizure control need to be addressed. The finding that blacks and respondents with less education and lower income had higher prevalences of active epilepsy is

FIGURE. Age-standardized prevalence of epilepsy medication use and seizure frequency among adults with active epilepsy, by receipt of specialty care in the past year — National Health Interview Survey, United States, 2013 and 2015



consistent with previous reports (*4*,*5*). This study also found that poor seizure control was associated with low income, unemployment, and being divorced, separated, or widowed. Socioeconomic disadvantage among adults with active epilepsy might preclude their accessing health care including specialty care (because of barriers such as cost and transportation) (*2*), thus affecting seizure control. More importantly, socioeconomic disadvantage (e.g., less education) and social isolation (e.g., lack of social support associated with being divorced, separated, or widowed) (*2*) might lead to nonadherence to epilepsy medication (*6*), an important clinical factor that significantly hinders seizure control (*6*,*7*).

Among adults taking epilepsy medication, those aged ≥65 years had better seizure control than among younger adults aged 35–54 years. This finding is also consistent with a previous report (*8*). The apparent better response to epilepsy medication in older adults might be attributable to differences in seizure etiology, drug pharmacokinetics, or better adherence to prescribed antiseizure medication regimens, possibly because of their experience with other chronic conditions or better access to care, including Medicare prescription drug coverage.

Only 44% of respondents with active epilepsy on epilepsy medication in this study were seizure-free in the past year. According to the Institute of Medicine, about 70% of all patients with epilepsy might become seizure-free under appropriate epilepsy treatment (*2*). To optimize seizure control, clinicians' decisions to treat epilepsy should be based on individualized assessments of both disease-based (e.g., age of disease onset, seizure etiology, type, and comorbid conditions) and treatment-based factors (e.g., adherence to antiepileptic drugs), as well as patients' personal characteristics, preferences, and their social context (*6*,*7*,*9*). Improving access to care, providing social support and epilepsy self-management education to improve medication adherence, and encouraging other self-management behaviors such as avoiding seizure triggers (e.g., sleep deprivation, stress, flashing lights, and alcohol or drug use) might also improve seizure control (*10*).

The findings in this report are subject to at least five limitations. First, estimates of epilepsy prevalence are based on self-reported data and are subject to error; however, because previous studies have validated the NHIS epilepsy questions, this bias is expected to be small (*3*). Second, active epilepsy might be overestimated because of the mistaken reporting of other nonepileptic seizures (*5*) or underestimated because of respondents' reluctance to disclose epilepsy (*2*), as well as by the exclusion of institutionalized adults (e.g., adults in long-term care facilities and incarcerated persons) from NHIS. Third, these surveys did not objectively measure medication adherence or seizure frequency. Fourth, although respondent survey weights were adjusted to the U.S. population, the potential for nonresponse bias cannot be eliminated, given the low overall response rate (58.2%). Finally, the lack of differences in seizure frequency by seeing a specialist could be confounded by epilepsy severity and other untreated comorbidity such as mood disorder. However, no data regarding epilepsy severity is collected on NHIS

These findings highlight both the substantial burden of uncontrolled seizures in adults with epilepsy and the persistent

sociodemographic and socioeconomic disparities in active epilepsy prevalence, access to neurologic specialty care, and seizure control. Health care and public health should ensure that adults with uncontrolled seizures have appropriate care and self-management support in order to promote seizure control, improve health and social outcomes, and reduce health care costs.

Conflict of Interest

No conflicts of interest were reported.

[1]Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Cutting Edge Technologies and Solutions (Cetechs), Mesa, Arizona.

Corresponding author: Niu Tian, NTian@cdc.gov, 770-488-5679.

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Protracted Outbreak of *Salmonella* Newport Infections Linked to Ground Beef: Possible Role of Dairy Cows — 21 States, 2016–2017

Katherine E. Heiman Marshall, MPH[1]; Mackenzie Tewell, MPH[2]; Selam Tecle, MPH[3]; Molly Leeper, MPH[1]; Jennifer Sinatra, DVM[4]; Bonnie Kissler, MPH[4]; Adrienne Fung, MPH[5]; Kerri Brown, MSPH[6]; Darlene Wagner, PhD[1]; Eija Trees, PhD[1]; Kelley B. Hise, MPH[1]; Vishnu Chaturvedi, PhD[7]; Linda K. Schlater, DVM[8]; Brenda R. Morningstar-Shaw, MS[8]; Laura Whitlock, MPH[1]; Kristin Holt, DVM[4]; Karen Becker, DVM[4]; Megin Nichols, DVM[1]; Ian T. Williams, PhD[1]; Michael Jhung, MD[1]; Matthew E. Wise, PhD[1]; Laura Gieraltowski, PhD[1]

In January 2017, CDC identified a cluster of *Salmonella enterica* serotype Newport infections with isolates sharing an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern, JJPX01.0010 (pattern 10), through PulseNet, the national molecular subtyping network for foodborne disease surveillance. This report summarizes the investigation by CDC, state and local health and agriculture departments, and the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS) and discusses the possible role of dairy cows as a reservoir for strains of *Salmonella* that persistently cause human illness. This investigation combined epidemiologic and whole genome sequencing (WGS) data to link the outbreak to contaminated ground beef; dairy cows were hypothesized to be the ultimate source of *Salmonella* contamination.

Epidemiologic Investigation

A case was defined as infection with *Salmonella* Newport with PFGE pattern 10 closely related to the outbreak strain by WGS, with bacterial isolation during October 1, 2016, through July 31, 2017. A total of 106 cases were identified in 21 states (Figure 1). Most illnesses ([72%]) were reported from southwestern states, including Arizona (30), California (25), New Mexico (14), and Texas (seven). Illness onset dates ranged from October 4, 2016, through July 19, 2017 (Figure 2). Patients ranged in age from <1–88 years (median = 44 years), and 53 (50%) were female. Among 88 (83%) patients with known outcomes, 42 (48%) were hospitalized, and one died.

Initial interviews identified consumption of ground beef as a common exposure among patients. A focused questionnaire was developed to collect detailed information on ground beef exposure and to obtain shopper card information and receipts. Among 65 interviewed patients, 52 (80%) reported eating ground beef at home in the week before illness began. This percentage was significantly higher than the 2006–2007 FoodNet Population Survey, in which 40% of healthy persons reported eating ground beef at home in the week before they were interviewed (p<0.001) (*1*). Among the 52 patients who ate ground beef at home, 31 (60%) reported that they bought it or maybe bought it from multiple locations of two national grocery chains, and 21 (40%) reported that they bought ground beef from locations of 15 other grocery chains. Specific ground beef information was available for 35 patients. Among these, 15 (43%) purchased ground beef as chubs (rolls) of varying sizes (range = 2–10 lbs), 18 purchased it on a tray wrapped in plastic, and two purchased preformed hamburger patties. Twenty-nine patients reported that they bought fresh ground beef, four bought frozen ground beef, and four did not recall whether it was fresh or frozen when purchased. When asked about ground beef preparation, 12 (36%) of 33 patients reported that they definitely or possibly undercooked it.

Traceback Investigation

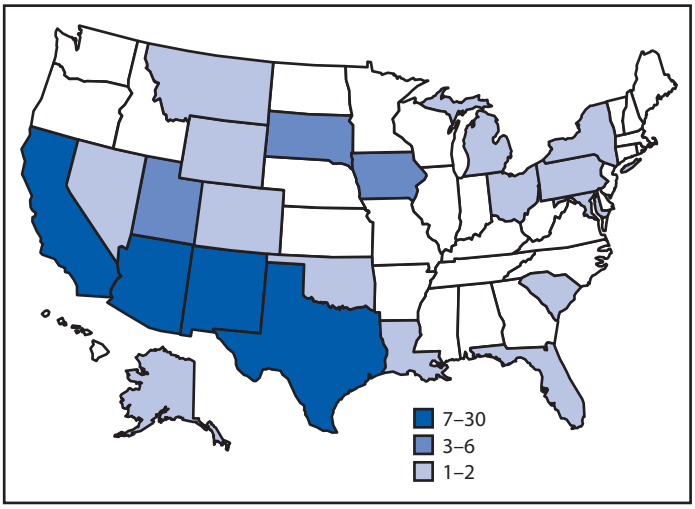
USDA-FSIS conducted traceback on ground beef purchased within 3 months of illness onset for 11 patients who provided shopper card records or receipts. Approximately 20 ground beef suppliers belonging to at least 10 corporations were identified; 10 of the 11 records traced back to five company A slaughter/processing establishments, seven of 11 traced back to five company B slaughter/processing establishments, and four of 11 traced back to two company C slaughter/processing establishments.

Product and Animal Testing

Opened, leftover samples of ground beef from three patients' homes were collected for testing. All were purchased from one of two national grocery chains that had been identified by a majority of patients. One sample, collected from ground beef removed from its original packaging, yielded the outbreak strain. The other two samples did not yield *Salmonella*.

The outbreak strain was also isolated from four New Mexico dairy cattle (Table). One was collected from a spontaneously aborted fetus in July 2016, and one was isolated from feces from a young calf in November 2016. The third isolate was identified by searching the USDA Animal and Plant Health Inspection Service National Veterinary Services Laboratory (USDA-APHIS NVSL) database for *Salmonella* Newport isolates collected from cattle in Arizona, California, Texas, New Mexico, and Wisconsin during January 2016–March 2017. Eighteen *Salmonella* Newport isolates were identified, including 13 from Texas, three from New Mexico, and two from Wisconsin. The only *Salmonella* Newport pattern 10 isolate

FIGURE 1. Infections with the outbreak strain of *Salmonella* Newport (n = 106), by state of residence — 21 states, October 2016–July 2017



identified was from a fecal sample from a New Mexico dairy cow collected during November 2016. The fourth isolate was from a USDA-FSIS routine cattle fecal sample collected at a Texas slaughter establishment in December 2016; USDA-FSIS determined the sample was from a dairy cow and identified the New Mexico farm of origin. Because of confidentiality practices, officials were not able to identify the farm or farms of origin for the dairy cows associated with the other three samples or whether the four dairy cows were associated with a single farm. None of the 11 patients with information for traceback ate ground beef produced at the Texas slaughter establishment.

Laboratory Investigation

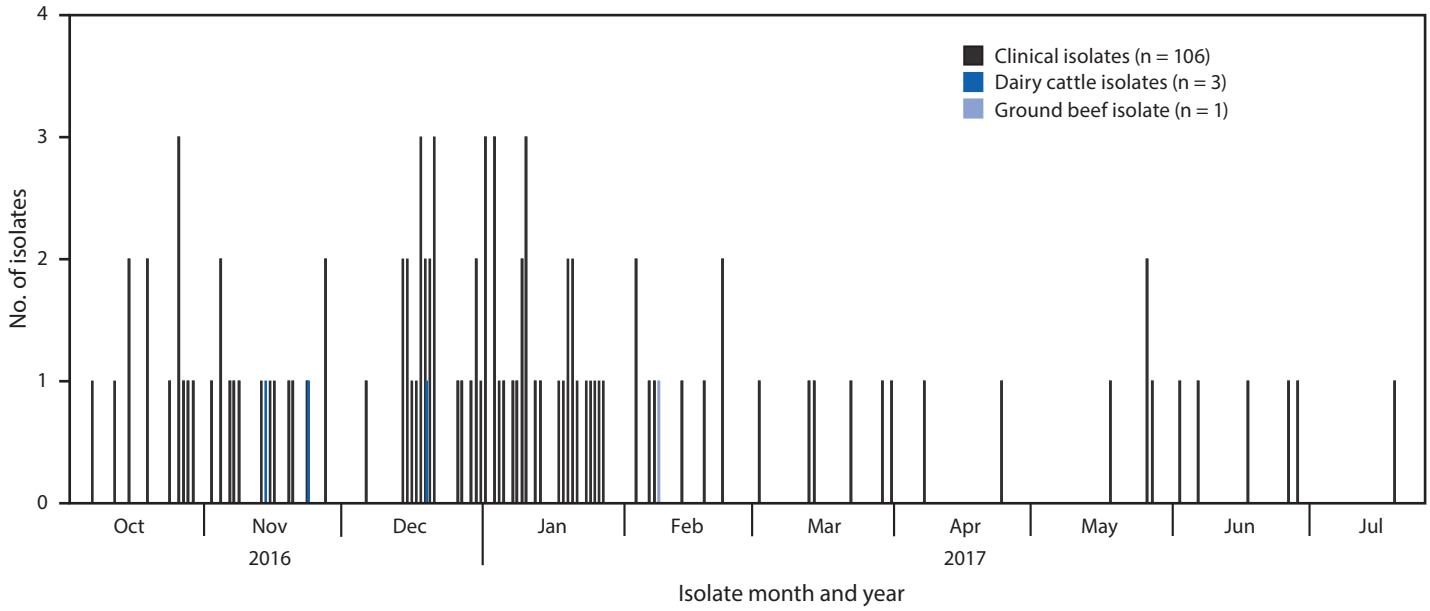
Whole genome high-quality single nucleotide polymorphism (SNP) analysis* showed that 106 clinical isolates were closely related to each other genetically, to the four dairy cattle isolates, and to the leftover ground beef isolate (range = 0–12 SNP differences), suggesting that the Salmonella bacteria found in patients, ground beef, and dairy cattle all shared a common source. Thirty-nine additional clinical isolates with PFGE pattern 10 were determined to not be closely related and were excluded from the outbreak. No antibiotic resistance was detected among three clinical isolates tested by CDC's National Antimicrobial Resistance Monitoring Laboratory.†

Public Health Response

Because the USDA-FSIS traceback investigation did not converge on a common production lot of ground beef or a single slaughter/processing establishment, and no ground beef in the original packaging yielded the outbreak strain, a recall of specific product was not requested. A public warning was not issued to consumers because specific, actionable information was not available (e.g., a specific brand or type of ground

* https://github.com/lskatz/lyve-SET.
† https://www.cdc.gov/narms/antibiotics-tested.html.

FIGURE 2. Isolates of the outbreak strain of *Salmonella* Newport from patients (n = 106), dairy cattle* (n = 3), and leftover ground beef (n = 1) — 21 states, October 2016–July 2017



* The isolate collected from a dairy cow fetus in July 2016 is not displayed because cases were reported during July–October 2016 but were not investigated as part of this outbreak.

TABLE. *Salmonella* Newport pattern 10 isolates with the outbreak strain collected from dairy cattle sourced from New Mexico, 2016

Isolate no.	Collection site	Isolation date	Sample source or reason for collection
1	Fetal tissue	Jul 7, 2016	Necropsy of cow fetus
2	Feces	Nov 14, 2016	Young calf
3	Feces	Nov 23, 2016	Cattle of unknown age collected because of infection*
4	Cecum	Dec 19, 2016	Routine sampling at slaughter facility in Texas; cow traced to New Mexico

Abbreviation: NVSL = USDA Animal and Plant Health Inspection Service National Veterinary Service Laboratory.
* Because of the anonymity of samples from cows routinely tested by NVSL, it is possible that this isolate is from the same sample as isolate 2.

beef). Officials in New Mexico visited the dairy farm that was the source of the cow at the Texas establishment and noted no concerns about conditions or practices. However, this visit occurred late in the investigation, and conditions at the time of the visit might not have represented those present immediately before and during the outbreak. No samples from the environment or cows were collected during this visit.

Discussion

Epidemiologic and laboratory evidence indicated that contaminated ground beef was the likely source of this protracted outbreak of *Salmonella* Newport infections. A significantly higher percentage of patients than expected ate ground beef at home, and a patient's leftover ground beef yielded the outbreak strain. Dairy cows colonized or infected with the outbreak strain before slaughter are hypothesized to be the ultimate outbreak source. Most U.S. ground beef is produced from beef cattle; however, 18% is produced from dairy cows (*2*). Dairy cows are sold for beef production through sale barns or directly to slaughter establishments as they age or if their milk production is insufficient (*2*). Previous studies have demonstrated long-term persistence of *Salmonella* Newport in dairy herds (*3*,*4*), and a 1987 *Salmonella* Newport outbreak was linked to contaminated ground beef from slaughtered dairy cows (*5*). In the current outbreak, as has been observed in previous outbreaks, ground beef purchases traced back to numerous lots and slaughter/processing establishments (*6*). One possible explanation is that dairy cows carrying a high *Salmonella* load that overwhelmed antimicrobial interventions could have gone to multiple slaughter/processing establishments (*7*), resulting in contamination of multiple brands and lots of ground beef. This might explain the reason for failure to identify a single, specific source of contaminated ground beef.

This investigation identified the outbreak strain only in samples from dairy cattle from New Mexico. All four isolates from dairy cattle samples were closely related genetically by WGS to isolates from patients, providing further evidence of a connection between dairy cattle in New Mexico and the outbreak. The disproportionate geographic distribution of cases in the U.S. Southwest, including New Mexico, also suggests a possible regional outbreak source. Although limited in scope, the query of the USDA-APHIS NVSL data identified the outbreak strain only from one New Mexico dairy cow (isolate 3), and the sample collection date was consistent with the timing of illnesses in this outbreak. The overall prevalence and geographic distribution of the outbreak strain in cattle is not known, and it is possible that cattle in states other than New Mexico might have been infected or colonized with the outbreak strain.

This was a complex and challenging investigation for several reasons. First, the PFGE pattern in the outbreak was not uncommon in PulseNet, making it difficult to distinguish outbreak cases from sporadic illnesses associated with the same *Salmonella* Newport pattern. WGS analysis provided more discriminatory power to refine the outbreak case definition and excluded 39 cases of illness from the outbreak. However, sequencing is not currently performed in real time for *Salmonella*, thereby slowing the process of determining which cases were likely outbreak-associated. In addition, a direct pathway linking outbreak cases to dairy cows infected with the outbreak strain of *Salmonella* Newport could not be established. This is because product traceback did not converge on a single contaminated lot of ground beef, and investigators were unable to ascertain a link between the beef slaughter/processing establishments identified during traceback and the farms with dairy cows that yielded the outbreak strain. Tracing back ground beef purchased by patients to slaughter/processing establishments requires documentation such as receipts or shopper card records, and only 10% of patients had this information available. For this outbreak, tracing back cows at slaughter/processing establishments to the farm from which they originated was problematic because cows were not systematically tracked from farm to slaughter/processing establishments.

Four points along the "farm to fork" continuum provide opportunities to prevent consumers from becoming ill from contaminated ground beef. First, farms can implement good management practices for cattle health, including vaccination, biosecurity (e.g., controlling movement of persons and animals on farms, keeping a closed herd [so that no animals on the farm are purchased, loaned to other farms, or have contact with other animals], planning introduction of new animals and quarantining them, and performing microbiologic testing of animals), and cleaning and disinfection measures to decrease *Salmonella* burden in animals and the environments in which they reside, reducing the likelihood that *Salmonella* will enter beef slaughter/processing establishments (*8*). Second,

Summary

What is already known about this topic?

Previous outbreaks of salmonellosis were linked to contaminated ground beef produced from slaughtered dairy cows.

What is added by this report?

Contaminated ground beef was the likely source of a protracted outbreak of 106 *Salmonella* Newport infections, 42 hospitalizations, and one death in 21 states during October 2016–July 2017. While no direct link was found, whole genome sequencing suggests dairy cows were the ultimate outbreak source.

What are the implications for public health practice?

Foodborne outbreak investigations could be enhanced by improvements in the traceability of cows from their originating farms or sale barns, through slaughter and processing establishments, to ground beef sold to consumers.

slaughter/processing establishments are required to maintain Hazard Analysis and Critical Control Points systems to reduce *Salmonella* contamination as well as slaughter and sanitary dressing procedures to prevent carcass contamination (*9*). Third, although *Salmonella* is not considered an adulterant in not-ready-to eat (NRTE) meat products, USDA-FSIS likely will consider the product to be adulterated when NRTE meat products are associated with an outbreak (*9*). Finally, consumers are advised to cook ground beef to 160°F (71°C) as measured by a food thermometer to destroy any bacteria that might be present. Consumers are also advised to wash hands, utensils, and surfaces often; separate and not cross-contaminate foods; and refrigerate foods promptly and properly.

This investigation emphasizes the utility of WGS during outbreak investigations and identifies the need for improvements in traceability from the consumer to the farm. It also highlights the importance of continued evaluation of farm practices to help reduce persistent *Salmonella* contamination on farms, contamination of ground beef, and ultimately human illness.

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Conflict of Interest

No conflicts of interest were reported.

[1]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [2]Arizona Department of Health Services; [3]California Department of Public Health; [4]Food Safety and Inspection Service, U.S. Department of Agriculture; [5]Texas Department of State Health Services; [6]Colorado Department of Public Health; [7]California Department of Public Health Microbial Diseases Laboratory; [8]National Veterinary Services Laboratory, Animal and Plant Health Inspection Service, U.S. Department of Agriculture.

Corresponding author: Katherine E. Heiman Marshall, kmarshall2@cdc.gov, 404-639-4405.

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Assessment of Community Awareness and Practices Concerning Indoor Air Pollutants — Madison County, Alabama, June 2017

Charlene Siza, DVM[1,2]; Melissa Morrison, MPH[3,4]; Scott Harris, MD[5]; Timothy Hatch, MPA[4]; Michael Tyler, MSW[4]

The Alabama Department of Public Health (ADPH) conducts an annual community assessment to evaluate household preparedness and local public health concerns. In June 2017, ADPH conducted a Community Assessment for Public Health Emergency Response (CASPER), focusing on indoor air pollutants in seven neighborhoods in Madison County, Alabama, where a large percentage of homes were built before 1980. Local health partners had concerns about indoor air quality and environmental risks such as radon; however, limited information was available regarding community awareness, prevention, and mitigation measures related to potential exposures. Weighted response frequencies were calculated from assessment responses. Among 192 household interview respondents, 78.4% were aware of potential indoor lead exposures, but only 12.6% of respondents living in houses built before 1978 reported that the house had been tested for lead. Similarly, respondents in 70.2% of households had heard of radon; however, only 7.3% of houses had been tested for radon. Smoking was reported by residents of 45.7% of households; among those, 48.4% reported that smoking occurred inside the house. Identified gaps in exposure prevention and mitigation, including low lead and radon testing rates and a high prevalence of indoor smoking, were shared with the local health department, and recommendations for timely interventions and policy guidance (e.g., targeted education campaigns and smoking cessation programs) were presented. Results of this CASPER demonstrated its usefulness and efficiency in gathering community-level data to help guide public health policies and timely interventions.

According to ADPH's Radon Program, Madison County's underground geology, which allows radon gas to accumulate and more readily enter houses and other buildings above ground, places it at high risk for elevated radon levels (*1*,*2*). The sampling frame for the CASPER included seven neighborhoods identified by community partners as having a majority of homes built before 1980. Census blocks that included these neighborhoods were obtained from 2010 U.S. Census data, which indicated that the sampling frame included 1,772 occupied houses with 4,486 residents. CASPER methodology was used (*3*); 30 census blocks were selected randomly from a total of 78 blocks, with the probability of selection proportional to the number of housing units in that block (hereafter referred to as clusters). Within each cluster, seven households were selected for interviews using systematic random sampling, for a target of 210 interviews. If one of the original seven households was not available or the residents refused to participate, systematic random sampling was used to select another household. Two-person interview teams conducted interviews with one respondent aged ≥18 years from each selected household. Contact was attempted at 407 households, and successful contact with a respondent was made at 281. Overall, 192 (91.4%) of the targeted 210 surveys were completed, representing a response rate* of 47.2% and a cooperation rate† of 68.3%.

The questionnaire for this assessment was adapted from previous CASPERs and established surveillance systems, including the Behavioral Risk Factor Surveillance System. Because of the reported high risk for exposure to indoor air pollutants, including lead and radon, in the selected neighborhoods, a special topics section was added to the questionnaire that focused on knowledge and prevention practices related to indoor air pollutants and included questions on exposure to tobacco smoke, mold, dust, and relevant respiratory health conditions in any household member.

Data were analyzed to obtain response frequencies for each question. Analysis was weighted to account for the complex sampling method and more accurately represent the sampling figure (*3*). Weighted percentages are reported.

Awareness of potential lead exposures in older homes was reported by residents of 78.4% of households (Table 1). Among 86 houses built before 1978, residents in 12.6% reported that lead testing had been conducted. Although no positive test results were reported, respondents in 29.3% of these households did not know or refused to report whether their homes had been tested. Overall, 14 (6.7%) respondents reported that a household resident had been previously tested for increased blood lead levels; among those tested, two were reported to have an elevated (≥5 μg/dL) blood lead level (weighted percentage 14.3%) (Table 1).

Respondents in 70.2% of households reported awareness of radon (Table 2). Although 87.8% of household respondents

* Response rate is calculated as the number of completed interviews divided by the number of households where contact was attempted.

† Cooperation rate is calculated as the number of completed interviews divided by the number of households where contact with a respondent was made.

TABLE 1. Awareness of potential for household lead exposure among survey respondents to a Community Assessment for Public Health Emergency Response — Madison County, Alabama, June 2017

Characteristic	No. of households (%)	Estimated no. of households*	Weighted % (95% CI)
Respondent aware of possible lead sources in older homes (n = 192)			
Yes	152 (79.2)	1,389	78.4 (76.4–80.2)
No	31 (16.1)	286	16.1 (14.5–17.9)
Don't know or refused	9 (4.7)	97	5.5 (4.5–6.6)
Was house tested for lead?†			
Yes	11 (12.8)	99	12.6 (10.4–15.1)
No	52 (60.5)	458	58.1 (54.6–61.5)
Don't know or refused	23 (26.7)	231	29.3 (26.3–32.6)
House tested positive for lead (n = 11)			
Yes	0	—	—
No	8 (72.7)	74	74.5 (65.0–82.9)
Don't know or refused	3 (27.3)	25	25.5 (17.1–35.0)
Household resident tested for elevated blood lead levels			
Yes	14 (7.3)	118	6.7 (5.6–7.9)
No	161 (83.9)	1486	83.9 (82.1–85.5)
Don't know or refused	17 (8.8)	168	9.5 (8.2–10.9)
Elevated blood lead level§ in tested household resident (n = 14)			
Yes	2 (14.3)	17	14.3 (8.6–22.0)
No	9 (64.3)	76	64.3 (55.1–73.0)
Don't know or refused	3 (21.4)	25	21.4 (14.2–29.7)

Abbreviation: CI = confidence interval.
* Obtained by weighting the frequencies. The weight for each cluster was calculated by dividing the total number of housing units in the sampling frame by the product of the number of housing units interviewed within the cluster and the number of clusters selected.
† Only asked for houses built before 1978 (N = 86).
§ ≥5 μg/dL.

TABLE 2. Awareness of potential for household radon exposure among survey respondents to a Community Assessment for Public Health Emergency Response — Madison County, Alabama, June 2017

Characteristic	No. of households (%)	Estimated no. of households*	Weighted % (95% CI)
Respondent had heard of radon (n = 192)			
Yes	131 (68.2)	1,244	70.2 (68.0–72.3)
No	59 (30.7)	511	28.8 (26.8–31.0)
Don't know or refused	2 (1.0)	17	1.0 (0.6–1.5)
Respondent agreed that prolonged radon exposure can be harmful (n = 131)			
Agree	113 (86.3)	1092	87.8 (85.9–89.5)
Disagree	0	—	—
Neither agree nor disagree	6 (4.6)	51	4.1 (3.1–5.3)
Don't know or refused	12 (9.2)	101	8.1 (6.7–9.8)
Respondent beliefs about possible health effects of radon (n = 113)			
Lung cancer	28 (24.8)	261	23.9 (21.4–26.5)
Respiratory concerns	9 (8.0)	97	8.9 (7.3–10.7)
Other	12 (10.6)	120	11.0 (9.3–13.0)
Don't know or no answer	64 (56.6)	614	56.2 (53.3–59.2)
Respondent aware that ADPH offers free radon test kit (n = 131)			
Yes	19 (14.5)	212	17.1 (15.1–19.3)
No	105 (80.2)	954	76.7 (74.2–78.9)
Don't know or refused	7 (5.3)	78	6.3 (5.1–7.8)
Was house tested for radon? (n = 131)			
Yes	10 (7.6)	91	7.3 (6.0–8.9)
No	95 (72.5)	921	74.1 (71.6–76.4)
Don't know or refused	26 (19.9)	232	18.7 (16.6–20.9)
House had elevated radon levels (n = 10)			
Yes	1 (10)	8	9.3 (3.9–16.7)
No	6 (60.0)	57	62.8 (51.9–72.6)
Don't know or refused	3 (30.0)	25	27.9 (18.8–38.1)
Plans to test house for radon in the next year (n = 131)			
Yes	13 (9.9)	113	9.1 (7.6–10.8)
No	66 (50.4)	631	50.7 (48.0–53.5)
Don't know or refused	52 (39.7)	500	40.2 (37.5–42.9)

Abbreviations: ADPH = Alabama Department of Public Health; CI = confidence interval.
* Obtained by weighting the frequencies. The weight for each cluster was calculated by dividing the total number of housing units in the sampling frame by the product of the number of housing units interviewed within the cluster and the number of clusters selected.

who reported awareness of radon agreed with the statement that prolonged exposure to radon could be harmful, only 23.9% were aware that prolonged radon exposure could cause lung cancer (*4*), and only 17.1% of household respondents were aware that a free radon test kit could be requested from the health department. Among 131 respondents reporting awareness of radon, 7.3% stated that their homes had already been tested.

Among other self-reported indoor pollutant exposures, excessive dust was most commonly reported (22.4% of households) (Table 3). Respondents in 45.7% of households reported any current smoking by at least one household member, and among these, 48.4% reported that smoking occurred indoors (22.1% of all households).

The most frequently reported respiratory diagnoses among respondents were allergies (45.0%) and asthma (21.5%). Diagnosed chronic obstructive pulmonary disease (COPD) (5.6%), emphysema (4.0%), and lung cancer (2.6%) were also reported. These conditions were reported separately as seen in other respiratory surveys, despite clinical and pathologic overlap. In the preceding 12 months, 58.1% of household respondents reported a resident who experienced allergies (Table 3).

Discussion

Among Madison County households at risk, interviews identified gaps in respondent knowledge and protective behaviors related to indoor air pollutants. A majority of household respondents reported being aware that lead exposure could exist in older homes; however, respondents in only a small percentage of houses built before 1978, when lead-based paint was banned for residential use, reported that their homes had been tested. Lead-based hazards from paint chips or an accumulation in dust or soil are more common in older homes (*5*). Creation of lead dust by sanding surfaces or removing old paint presents a hazard during home remodeling or renovation (*6*). This might not only pose a risk to household residents, but also an occupational risk to workers who perform these renovations.

TABLE 3. Selected self-reported indoor pollutant exposures, smoking status, health conditions, and symptoms — Community Assessment for Public Health Emergency Response, Madison County, Alabama, June 2017

Characteristic*	No. of households (%)	Estimated no. of households†	Weighted % (95% CI)
Selected indoor pollutant exposures (n = 192)§			
Excessive dust	42 (21.9)	397	22.4 (20.5–24.4)
Excessive moisture	18 (9.4)	183	10.3 (9.0–11.8)
Mold growth	17 (8.9)	181	10.2 (8.9–11.7)
Unusual odors	16 (8.3)	148	8.3 (7.1–9.7)
None of the above	117 (60.9)	1,068	60.3 (58.0–62.5)
Don't know or refused	18 (9.4)	158	8.9 (7.7–10.4)
Household has a current smoker (n = 192)			
Yes	84 (43.8)	811	45.7 (43.4–48.1)
No	106 (55.2)	945	53.3 (51.0–55.6)
Don't know or refused	2 (1.0)	17	1.0 (0.6–1.5)
Smoker smokes inside the house (n = 84)			
Yes	41 (48.8)	392	48.4 (45.0–51.9)
No	43 (51.2)	418	51.6 (48.2–55.0)
Health care provider diagnosed one of these conditions in household member (n = 192)			
Allergies	84 (43.8)	798	45.0 (42.7–47.4)
Asthma	44 (22.9)	381	21.5 (19.7–23.5)
COPD	11 (5.7)	99	5.6 (4.6–6.8)
Emphysema	8 (4.2)	71	4.0 (3.2–5.0)
Lung cancer	3 (1.6)	46	2.6 (2.0–3.5)
None of the above	85 (44.3)	774	43.7 (41.4–46.0)
Don't know or refused	3 (1.6)	25	1.4 (1.0–2.1)
Household member experienced these conditions/symptoms in past 12 months (n = 192)			
Allergies	114 (59.4)	1,030	58.1 (55.8–60.4)
Migraine	48 (25.0)	449	25.3 (23.3–27.4)
Sinus infection	42 (21.9)	403	22.7 (20.9–24.8)
Sore throat	38 (19.8)	379	21.4 (19.5–23.4)
Wheezing or asthma attack	38 (19.8)	337	19.0 (17.2–20.9)
Conjunctivitis	33 (17.2)	322	18.2 (16.4–20.0)
Bronchitis	29 (15.1)	267	15.1 (13.5–16.8)
Laryngitis	11 (5.7)	99	5.6 (4.6–6.8)
None of the above	42 (21.9)	395	22.3 (20.4–24.3)
Don't know or refused	5 (2.6)	42	2.4 (1.8–3.2)

Abbreviations: CI = confidence interval; COPD = chronic obstructive pulmonary disease.

* Characteristics based on self-report.

† Obtained by weighting the frequencies. The weight for each cluster was calculated by dividing the total number of housing units in the sampling frame by the product of the number of housing units interviewed within the cluster and the number of clusters selected.

§ Excessive dust, excessive moisture, and unusual odors based on respondent's subjective report. Mold growth was defined as larger than the size of a $1 bill.

A second important indoor air pollutant is radon, a naturally occurring radioactive gas that is the second leading cause of lung cancer after cigarette smoking (*4*). Madison County is an area with a high potential for elevated radon levels (*2*). The majority of household respondents reported awareness of radon, but fewer than a quarter knew that it could cause lung cancer. More importantly, few houses had been tested for elevated indoor radon levels. Although free test kits are available through the health department, few respondents knew of this service.

Summary

What is already known about this topic?

Community Assessment for Public Health Emergency Response (CASPER) is a household-level rapid assessment commonly used during disasters and emergency preparedness planning.

What is added by this report?

The CASPER conducted among 192 households in Madison County, Alabama, about selected indoor air pollutants and routine emergency preparedness found the majority of residents were aware of potential indoor lead exposures and had heard of radon but most had not tested for either. Smoking inside the house occurred among 22% of households.

What are the implications for public health practice?

Using the CASPER methodology in nondisaster settings to collect community-specific data can guide targeted intervention and prevention recommendations for local public health departments and their community partners.

In addition to possible harmful exposures related to lead and radon in the home, respondents in nearly half of households reported that at least one resident in the home smoked, and in almost half of these houses, smoking indoors was reported. Smoking, especially indoors, might result in exposure of other household members to secondhand smoke, which is known to increase the risk for cancer, respiratory diseases, and cardiovascular diseases including stroke (*7*). Educating residents about the dangers of secondhand smoke exposure and the benefits of implementing smoke-free rules in their households is an important intervention that, along with smoking cessation and support programs, can improve health in these neighborhoods (*8*).

Interviews with members of households indicated that, among respiratory conditions diagnosed by health care providers, allergies and asthma were the most prevalent although other severe conditions such as emphysema, COPD, and lung cancer also were reported. Although causality cannot be inferred from this analysis, information on respiratory conditions prevalent in these areas could be used to help prioritize interventions potentially related to indoor air pollutant exposures.

The findings of this report are subject to at least two limitations. First, although households were systematically selected, participation was voluntary, and the findings might be subject to response and social desirability biases, which could overestimate the prevalence of certain health conditions or reported knowledge about indoor pollutants. In addition, the information gathered by the CASPER is only representative of the sampling frame chosen and cannot be used to draw conclusions about other communities or regions in Alabama.

Conducting a community assessment is a relatively rapid and inexpensive way to obtain a better understanding of the current health-related needs of a community. This assessment obtained data on knowledge and prevention practices related to indoor air pollutants in neighborhoods known to be at increased risk and suggested that community health interventions to raise awareness of the importance of testing homes for lead and providing educational resources to reduce lead exposure risks when remodeling older homes are needed. In addition, the findings provide evidence that public health programs need to increase awareness of radon testing and mitigation options in these neighborhoods with a high risk for radon exposure as well as provide smoking cessation options and education about secondhand smoke effects. Community-specific data can aid policy makers and local or federal partners in developing and implementing targeted interventions.

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Conflict of Interest

No conflicts of interest were reported.

[1]Epidemic Intelligence Service, CDC; [2]Bureau of Communicable Disease, Alabama Department of Public Health; [3]Division of State and Local Readiness, Office of Public Health Preparedness and Response, CDC; [4]Center for Emergency Preparedness, Alabama Department of Public Health; [5]Office of the State Health Officer, Alabama Department of Public Health.

Corresponding author: Charlene Siza, csiza@cdc.gov, 334-206-5971.

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Suicidal Ideation and Attempts Among Students in Grades 8, 10, and 12 — Utah, 2015

Marissa L. Zwald, PhD[1,2]; Francis B. Annor, PhD[1,3]; Amanda Wilkinson, PhD[1,4]; Mike Friedrichs, MS[5]; Anna Fondario, MPH[5]; Angela C. Dunn, MD[5]; Allyn Nakashima, MD[5]; Leah K. Gilbert, MD[3]; Asha Ivey-Stephenson, PhD[3]

Suicidal thoughts and behaviors among youths are important public health concerns in Utah, where the suicide rate among youths consistently exceeds the national rate and has been increasing for nearly a decade (*1*). In March 2017, CDC was invited to assist the Utah Department of Health (UDOH) with an investigation to characterize the epidemiology of fatal and nonfatal suicidal behaviors and identify risk and protective factors associated with these behaviors, among youths aged 10–17 years. This report presents findings related to nonfatal suicidal behaviors among Utah youths. To examine the prevalence of suicidal ideation and attempts among Utah youths and evaluate risk and protective factors, data from the 2015 Utah Prevention Needs Assessment survey were analyzed. Among 27,329 respondents in grades 8, 10, and 12, 19.6% reported suicidal ideation and 8.2% reported suicide attempts in the preceding 12 months. Significant risk factors for suicidal ideation and attempts included being bullied, illegal substance or tobacco use in the previous month, and psychological distress. A significant protective factor for suicidal ideation and attempts was a supportive family environment. UDOH, local health departments, and other stakeholders are using these findings to develop tailored suicide prevention strategies that address multiple risk and protective factors for suicidal ideation and attempts. Resources such as CDC's *Preventing Suicide: A Technical Package of Policy, Programs, and Practices* (*2*) can help states and communities identify strategies and approaches using the best available evidence to prevent suicide, which include tailored strategies for youths.

The Utah Prevention Needs Assessment is a cross-sectional, school-based health and risk behavior survey conducted biennially in randomly selected public and charter schools in Utah among a representative sample of students in grades 6, 8, 10, and 12 (*3*). The survey is anonymous, and students are required to have parental consent to participate. The school sample is stratified by district; data were weighted to account for the probability of selection and the distribution of students by sex, grade, and race using iterative proportional fitting. Additional survey details are available elsewhere (*3*). Among 75,652 youths sampled for the 2015 Utah Prevention Needs Assessment survey, 48,975 (64.7%) participated. For this analysis, 29,089 students aged <18 years in grades 8, 10, and 12 were considered eligible. Approximately 6% of eligible participants were excluded because of missing outcome data, yielding a final analytic sample of 27,329.

Suicidal ideation was defined as an affirmative response to either of the following questions: "During the past 12 months, did you ever seriously consider attempting suicide?" (Yes or No) or "During the past 12 months, did you make a plan about how you would attempt suicide?" (Yes or No). Suicidal attempt was assessed by the response to the question "During the past 12 months, how many times did you actually attempt suicide?" Response options were 0, 1, 2–3, 4–5, or ≥6 times. Because of a skewed distribution, where a small percentage of youths reported multiple suicide attempts (4.2% reported 1; 2.6% reported 2–3; 0.7% reported 4–5; and 0.7% reported ≥6), responses were dichotomized to none (zero times) and ≥1 (≥1 time). Data from additional questions were used to measure risk factors, including bullying on school property in the previous year, electronic bullying in the previous year, any illicit substance use in the previous month, any tobacco use in the previous month, and psychological distress. Protective factors assessed were perceptions of prosocial behaviors and separate measures for a supportive community, school, peer, and family environment (*4*). Data were analyzed by selected demographic characteristics and weighted to provide estimates of suicidal ideation and attempts with accompanying 95% confidence intervals (CIs). Multivariate logistic regression analyses were conducted to examine risk and protective factors associated with suicidal ideation and attempts in the previous 12 months controlling for all other factors and demographic characteristics informed by prior research (*5–10*): sex, age, race, religious preference, and highest level of education in the household. Adjusted odds ratios (AORs) and 95% CIs were calculated, with $p<0.05$ considered statistically significant. Variables in the final models were screened for multicollinearity. Statistical software was used to account for the complex survey design.

In 2015, approximately 20% of students in grades 8, 10, and 12 who participated in the Utah Prevention Needs Assessment survey reported suicidal ideation and 8.2% reported having attempted suicide during the past 12 months (Table 1). Prevalence of suicidal ideation and attempts were highest among students who were female, aged 15–17 years, in grade 10, nonwhite, less religious, nonmembers of the Church of Latter Day Saints, and had a household education attainment level of

TABLE 1. Prevalence of suicidal ideation and attempt during the past 12 months among students in grades 8, 10, and 12, by selected characteristics — Utah Prevention Needs Assessment Survey, Utah, 2015

Characteristic	No. in sample (weighted %)	Suicidal ideation*			≥1 suicide attempt†		
		No.	% (95% CI)	p-value§	No.	% (95% CI)	p-value§
Total	**27,329**	**5,347**	**19.6 (18.6–20.7)**	—	**2,338**	**8.2 (7.6–8.8)**	—
Sex							
Male	12,706 (49.9)	1,680	13.7 (12.6–14.9)	<0.001	634	5.0 (4.4–5.6)	<0.001
Female	14,507 (50.1)	3,631	25.5 (24.1–27.0)		1,693	11.4 (10.5–12.4)	
Age group (yrs)							
12–14	13,111 (40.9)	2,399	17.0 (15.9–18.2)	<0.001	1,135	7.9 (7.1–8.7)	0.395
15–17	14,218 (59.1)	2,948	21.4 (20.0–22.9)		1,203	8.4 (7.6–9.3)	
Grade							
8	13,206 (41.2)	2,421	17.1 (15.9–18.3)	<0.001	1,148	7.9 (7.1–8.8)	0.001
10	10,616 (41.8)	2,299	22.6 (20.8–24.6)		977	9.4 (8.3–10.7)	
12	3,507 (17.1)	627	18.5 (16.7–20.6)		213	5.8 (4.8–7.1)	
Race							
White	21,988 (80.9)	4,095	18.7 (17.6–19.9)	<0.001	1,653	7.2 (6.6–7.9)	<0.001
Nonwhite	5,208 (19.1)	1,225	23.4 (21.7–25.2)		673	12.3 (11.2–13.4)	
Religious attendance¶							
Religious	17,479 (67.7)	2,762	16.1 (15.2–17.1)	<0.001	1,079	5.9 (5.3–6.5)	<0.001
Less religious	8,792 (32.2)	2,400	27.4 (25.9–29.1)		1,158	13.0 (11.9–14.2)	
Religious preference**							
LDS (Mormon)	16,120 (62.7)	2,398	15.3 (14.4–16.4)	<0.001	865	5.1 (4.6–5.7)	<0.001
Other	9,982 (37.3)	2,717	27.1 (25.5–28.7)		1,339	13.0 (11.9–14.2)	
Highest household education level							
Less than high school	1,561 (6.4)	472	27.6 (24.4–31.1)	<0.001	277	15.6 (13.2–18.3)	<0.001
High school graduate or some college	7,707 (30.8)	1,853	23.4 (21.9–25.0)		849	10.3 (9.2–11.4)	
College graduate	14,649 (62.7)	2,336	16.9 (15.8–18.1)		850	6.0 (5.4–6.7)	

Abbreviations: CI = confidence interval; LDS = Latter Day Saints.

* Suicidal ideation defined as a response of "yes" to either of the following questions: "During the past 12 months, did you ever seriously consider attempting suicide?" and "During the past 12 months, did you make a plan about how you would attempt suicide?"

† Suicidal attempt was based on a question asking "During the past 12 months, how many times did you actually attempt suicide? Response options were 0 times, 1 time, 2–3 times, 4–5 times, or ≥6 times. Responses were dichotomized to none (0 times) and ≥1 (1 or more times).

§ p-value for Chi-square test.

¶ Based on a question asking "How often do you attend religious service or activities?" Responses of attends 1–2 times per month and about once a week or more were categorized as "religious" and responses of never and rarely were categorized as "less religious."

** Based on a question asking "Which is your religious preference (choose the ONE religion with which you identify the most)?" Responses of Catholic, Jewish, Protestant, another religion, or no religious preference were categorized as "Other."

less than high school. After adjusting for the other factors and for demographic characteristics, odds of suicidal ideation were higher among students who were bullied on school property (AOR = 1.95; 95% CI = 1.54–2.48) or electronically (1.82; 1.46–2.26) in the previous year, who reported illicit substance use (1.93; 1.42–2.62) or tobacco use (1.54; 1.14–2.09) in the previous month, and who reported moderate psychological distress (5.67; 4.42–7.28) or serious psychological distress (16.37; 12.12–22.10) (Table 2). Risk for suicide attempt was higher among students who were bullied on school property (2.17; 1.59–2.96), electronically bullied (1.71; 1.19–2.45), used an illicit substance in the previous month (1.90; 1.32–2.74), used tobacco in the previous month (1.70; 1.10–2.63), and reported moderate (3.80; 2.40–6.01) or serious (8.91; 5.75–13.80) psychological distress. A supportive family environment was protective against suicidal ideation (0.86; 0.83–0.90) and suicide attempts (0.87; 0.83–0.93). Nonsignificant protective factors for both suicidal ideation and suicide attempts included prosocial behaviors, and supportive community, school, and peer environments.

Discussion

Data from Utah's largest school health and risk behavior survey on suicidal ideation and suicide attempts among students in grades 8, 10, and 12 indicate that in 2015, approximately one in five Utah youths reported suicidal ideation and 8.2% attempted suicide during the previous 12 months. Consistent with previous evidence and an investigation of youth suicide in California (*5*,*6*), nonfatal suicidal behaviors examined in the current investigation differed from those of completed suicides among Utah youths described elsewhere (*6*). For example, the prevalence of suicidal ideation and suicide attempts were highest among females and nonwhites, whereas rates of completed suicide among youths in Utah during 2011–2015 were higher among males (11.8 per 100,000 [95% CI = 9.7–14.0]) than among females (3.7 [2.5–5.1]) and among whites (8.3

TABLE 2. Adjusted odds ratios of suicidal ideation and suicide attempt during the preceding 12 months among students in grades 8, 10, and 12 — Utah Prevention Needs Assessment Survey, Utah, 2015

Characteristic	AOR* (95% CI)	
	Suicidal ideation†	Suicide attempt§
Risk factor		
Bullied on school property in the previous year¶	1.95 (1.54–2.48)	2.17 (1.59–2.96)
Electronically bullied in the previous year¶	1.82 (1.46–2.26)	1.71 (1.19–2.45)
Any substance use in the previous month**	1.93 (1.42–2.62)	1.90 (1.32–2.74)
Any tobacco use in the previous month**	1.54 (1.14–2.09)	1.70 (1.10–2.63)
Psychological distress††		
No distress	Referent	Referent
Moderate distress	5.67 (4.42–7.28)	3.80 (2.40–6.01)
Serious distress	16.37 (12.12–22.10)	8.91 (5.75–13.80)
Protective factor		
Prosocial behaviors§§	1.01 (0.99–1.03)	0.99 (0.96–1.02)
Supportive community environment¶¶	0.98 (0.94–1.02)	0.95 (0.90–1.01)
Supportive school environment***	1.03 (0.99–1.08)	1.05 (0.99–1.12)
Supportive peer environment†††	1.01 (1.00–1.03)	1.00 (0.97–1.02)
Supportive family environment§§§	0.86 (0.83–0.90)	0.87 (0.83–0.93)

Abbreviations: AOR = adjusted odds ratio; CI = confidence interval.

* Multivariate models adjusted for all other factors in the model and sex, age, race, religious preference, and highest education level of entire household.

† Suicidal ideation defined as a response of "yes" to either of the following questions: "During the past 12 months, did you ever seriously consider attempting suicide?" and "During the past 12 months, did you make a plan about how you would attempt suicide?"

§ Suicide attempt was based on a question asking "During the past 12 months, how many times did you actually attempt suicide? Response options were 0 times, 1 time, 2–3 times, 4–5 times, or ≥6 times. Responses were dichotomized to none (0 times) and ≥1 (1 or more times).

¶ Referent = not bullied.

** Referent = no use. Substance use defined as using any alcohol, marijuana, or illicit drugs in the previous month. Tobacco use defined as using any tobacco product, including e-cigarettes, in the previous month.

†† Psychological distress was estimated using the Kessler K6 scale (https://www.ncbi.nlm.nih.gov/pubmed/12214795) which screens for psychological distress by asking students "During the past 30 days, how often did you (a) feel nervous, (b) feel hopeless, (c) feel restless or fidgety, (d) feel so depressed that nothing could cheer you up, (e) feel that everything was an effort, (f) feel worthless? Answers to each were scored based on the following responses: "None of the time" (0 points); "A little of the time" (1 point); "Some of the time" (2 points); "Most of the time" (3 points); and "All of the time" (4 points). The psychological distress variable was created by generating a composite score from the six items above. Students with a total score of ≥13 points were determined to have high psychological distress; students with a score of 7–12 points were considered to have moderate psychological distress; and students with a score of 0–6 points were considered to have no psychological distress (α = 0.91).

§§ For prosocial behaviors, a mean score was calculated from the following three items, which were on an 8-point Likert scale. Items asked included how many times in the past year "Have you participated in clubs, organizations, or activities at school?"; "Have you done extra work on your own for school?"; and "Have you volunteered to do community service?" A higher mean score indicated stronger prosocial behaviors, with a possible range of 1–24 (α = 0.70).

¶¶ For supportive community level environment, a mean score was calculated from the following three items, which were on a 4-point Likert scale. Statements included the following: "My neighbors notice when I am doing a good job and let me know about it"; "There are people in my neighborhood who are proud of me when I do something well"; and "There are people in my neighborhood who encourage me to do my best." A higher mean score indicated a more supportive community level environment, with a possible range of 1–12 (α = 0.90).

*** For supportive school environment, a mean score was calculated from the following five items, which were on a 4-point Likert scale. Statements included the following: "In my school, students have lots of chances to help decide things like class activities and rules"; "There are lots of chances for students in my school to talk with a teacher one-on-one"; "My teachers notice when I am doing a good job and let me know about it"; "I have lots of chances to be part of class discussions or activities"; and "Teachers ask me to work on special classroom projects." A higher mean score indicates a more supportive school environment, with a possible range of 1–20 (α = 0.69).

††† For supportive peer environment, a mean score was calculated from five items, which were on a 5-point Likert scale. Items asked in the past year included how many of your best friends have "Participated in school clubs"; "Made a commitment to stay drug-free"; "Tried to do well in school"; "Have liked school"; and "Regularly attended religious services." A higher mean score indicated a more supportive peer environment, with a possible range of 1–25 (α = 0.79).

§§§ For supportive family environment, a mean score was calculated from the following three items, which were on a 4-point Likert scale. Statements included the following: "My parents ask me what I think before most family decisions affecting me are made"; "If I had a personal problem, I could ask my mom or dad for help"; and "My parents give me lots of chances to do fun things with them." A higher mean score indicated stronger family environments, with a possible range of 1–12 (α = 0.84).

[6.8–9.7]) than among nonwhites (6.5 [4.1–8.9]) (*7*). Past research has demonstrated similar sex differences in nonfatal and fatal suicidal behaviors among youths. Rates of suicidal ideation and suicide attempts are higher among adolescent females in the United States, whereas rates of completed suicide are higher among adolescent males, which is in part a consequence of the choice of more lethal suicide attempt methods among males (*1*,*8*–*10*).

Several factors were associated with a higher risk for suicidal thoughts and behaviors, including being bullied at school and online, recently using illicit substances and tobacco, and experiencing psychological distress. Youths with a supportive family environment had a lower risk for suicidal ideation and suicide attempts, which has been demonstrated in previous studies related to the family environment and suicidal thoughts and behaviors, where family cohesion, positive parent-child connection, time spent together, parental supervision, and high parental expectations of academics and behaviors were protective against suicidal behaviors (*8*,*9*). Public health professionals in Utah who are developing and implementing youth suicide prevention interventions might consider extending initiatives to the home environment to include family members and addressing protective and risk factors identified in this investigation.

Summary

What is already known about this topic?

The youth suicide rate in Utah is consistently higher than the national rate and has been increasing for nearly a decade.

What is added by this report?

In 2015, approximately 20% of youths in Utah considered suicide, and 8% attempted suicide. Youths who were bullied, reported recent illicit substance or tobacco use, and experienced psychological distress had a higher risk for suicidal ideation and attempts. Youths with a supportive family environment had a lower risk for suicidal thoughts and behaviors.

What are the implications for public health practice?

These results can help guide suicide prevention strategies in Utah and elsewhere. CDC's evidence-based *Preventing Suicide: A Technical Package of Policy, Programs, and Practices* includes tailored strategies for youths.

The findings in this report are subject to at least three limitations. First, because the survey is cross-sectional in nature, whether the risk and protective factors assessed were precursors or consequences of suicidal ideation and attempts could not be determined. Second, these data apply only to students in grades 8, 10, and 12 who were attending Utah public and charter schools and are not representative of all persons in these grades. Finally, data are self-reported and possibly subject to underreporting or overreporting of suicidal thoughts and behaviors because of, for example, unwillingness to disclose certain experiences and recall bias.

Continued surveillance for suicidal thoughts and behaviors among Utah youths is important to planning, implementing, and evaluating public health interventions aimed at preventing youth suicide. Possible prevention strategies to consider could include integrating family members and the home setting into existing or new interventions and identifying and addressing the needs of youths exhibiting risk factors identified in this investigation (e.g., being bullied, using illegal substances or tobacco, or experiencing psychological distress). Resources such as CDC's *Preventing Suicide: A Technical Package of Policy, Programs, and Practices* (*2*) can help states and communities identify strategies and approaches using the best available evidence to prevent suicide, which include tailored strategies for youths. Public health professionals and other stakeholders might consider employing the outlined strategies in the technical package to help address suicidal thoughts and behaviors among Utah youths.

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Conflict of Interest

No conflicts of interest were reported.

[1]Epidemic Intelligence Service, CDC; [2]Division of Health and Nutrition Examination Surveys, National Center for Health Statistics, CDC; [3]Division of Violence Prevention, National Center for Injury Prevention and Control, CDC; [4]Child Health and Mortality Prevention Surveillance (CHAMPS), Center for Global Health, CDC; [5]Utah Department of Health, Salt Lake City, Utah.

Corresponding author: Marissa Zwald, mzwald@cdc.gov, 301-458-4041.

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Recommendations of the Advisory Committee on Immunization Practices for Use of a Hepatitis B Vaccine with a Novel Adjuvant

Sarah Schillie, MD[1]; Aaron Harris, MD[1]; Ruth Link-Gelles, PhD[1]; José Romero, MD[2]; John Ward, MD[1]; Noele Nelson, MD[1]

Hepatitis B (HepB) vaccination is the primary means of preventing infections and complications caused by hepatitis B virus (HBV). On February 21, 2018, the Advisory Committee on Immunization Practices (ACIP) recommended Heplisav-B (HepB-CpG), a yeast-derived vaccine prepared with a novel adjuvant, administered as a 2-dose series (0, 1 month) for use in persons aged ≥18 years. The ACIP Hepatitis Vaccines Work Group conducted a systematic review of the evidence, including data from four randomized controlled trials assessing prevention of HBV infection and six randomized controlled trials assessing adverse events in adults. Seroprotective antibody to hepatitis B surface antigen (anti-HBs) levels were achieved in 90.0%–100.0% of subjects receiving HepB-CpG (Dynavax Technologies Corporation), compared with 70.5%–90.2% of subjects receiving Engerix-B (GlaxoSmithKline Biologicals). The benefits of protection with 2 doses administered over 1 month make HepB-CpG an important option for prevention of HBV.

Introduction

Vaccination is the primary means for preventing hepatitis B virus (HBV) infection and its complications. Existing hepatitis B (HepB) vaccines use an aluminum adjuvant. On November 9, 2017, Heplisav-B (HepB-CpG), a single-antigen HepB vaccine with a novel immunostimulatory sequence adjuvant, was approved by the Food and Drug Administration for the prevention of HBV in persons aged ≥18 years. The vaccine is administered as 2 doses, 1 month apart (*1*). On February 21, 2018, the Advisory Committee on Immunization Practices (ACIP)* recommended HepB-CpG for use in persons aged ≥18 years.

HepB-CpG contains yeast-derived recombinant HepB surface antigen (HBsAg) and is prepared by combining purified HBsAg with small synthetic immunostimulatory cytidine-phosphate-guanosine oligodeoxynucleotide (CpG-ODN) motifs (1018 adjuvant). The 1018 adjuvant binds to Toll-like receptor 9 to stimulate a directed immune response to HBsAg (*1*).

HepB-CpG is available in single-dose 0.5 mL vials. Each dose contains 20 μg of HBsAg and 3,000 μg of 1018 adjuvant. HepB-CpG is formulated without preservatives and is administered as an intramuscular injection in the deltoid region of the upper arm (*1*).

HepB-CpG is the fifth inactivated HepB vaccine currently recommended for use in the United States. This report contains ACIP guidance specific to HepB-CpG and augments the 2018 ACIP recommendations for the prevention of HBV infection (*2*). This report does not include new guidance for populations recommended to receive HepB vaccination or immunization management issues other than those that pertain specifically to HepB-CpG. The intended audience for this report includes clinical and public health personnel who provide HepB vaccination services to adults. These recommendations are meant to serve as a source of guidance for health care providers; health care providers should always consider the individual clinical circumstances of each patient.

Methods

From February 2016 to January 2018, the ACIP Hepatitis Vaccines Work Group† participated in three teleconference meetings to review the quality of evidence for immunogenicity and safety of HepB-CpG and implementation issues. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach for evaluating evidence was adopted by ACIP in 2010 (https://www.cdc.gov/vaccines/acip/recs/grade/). The Work Group identified critical and important outcomes for inclusion in the GRADE tables, conducted a systematic review of the evidence, and subsequently reviewed and discussed findings and evidence quality (*3*). Key outcomes were designated as critical (hepatitis B infection, severe adverse events, and cardiovascular safety) or important (mild adverse events). Factors considered in determining the recommendation included benefits and harms and evidence type. Values and preferences and economic factors were not systematically considered.

* ACIP is chartered as a federal advisory committee that provides expert external advice and guidance to the Director of CDC on use of vaccines and related agents for the control of vaccine-preventable diseases in the U.S. civilian population. ACIP recommendations adopted by the CDC Director become agency guidelines on the date published in *MMWR*.

† The ACIP Hepatitis Vaccines Work Group comprises professionals from academic medicine (family medicine, internal medicine, pediatrics, obstetrics, infectious disease, occupational health, and preventive medicine specialists), federal and state public health entities, and medical societies.

The scientific literature was searched through a systematic review of Medline (Ovid), CAB Abstracts, Embase, Global Health (Ovid), Scopus, and Cochrane databases. Search terms included "Heplisav," "HBV-ISS," "HBsAg-1018," "1018 immunostimulatory sequence," and "hepatitis B surface antigen-1018 ISS." To qualify as a candidate for inclusion in the review, a study had to present immunogenicity or disease endpoints or safety data on HepB-CpG. Studies were excluded if they were basic science, a secondary data analysis, immunogenicity outcomes for a nonlicensed formulation or use of HepB-CpG, a general review or opinion perspective, conducted on nonhuman primates, or if data could not be abstracted. Supporting evidence for the Work Group's findings is available online (https://www.cdc.gov/vaccines/acip/recs/grade/hepb.html).

A summary of Work Group discussions was presented to ACIP on October 25, 2017, and February 21, 2018. At the February 2018 meeting, a proposed recommendation was presented to the committee, and, after a public comment period, was approved by the voting ACIP members as follows: HepB-CpG is recommended as an option for HepB vaccination for persons aged ≥18 years (14 voted in favor, with none opposed, none abstained, and none recused). This report summarizes the data considered, the quality of evidence, and the rationale for the recommendation.

Summary of Key Findings

The body of evidence consisted of four randomized controlled trials assessing prevention of HBV infection and six randomized controlled trials assessing adverse events (mild adverse events, serious adverse events, and cardiovascular adverse events) in adult subjects. Outcomes compared HepB-CpG with Engerix-B. Data from these studies informed HepB-CpG licensure. Studies assessing prevention of HBV infection used antibody to hepatitis B surface antigen (anti-HBs) ≥10 mIU/mL as a serologic correlate of protection. Protection among 7,056 subjects receiving 2 doses of HepB-CpG was compared with protection among 3,214 subjects receiving 3 doses of Engerix-B. Seroprotective anti-HBs levels were achieved in 90.0%–100.0% of subjects receiving HepB-CpG, compared with 70.5%–90.2% of subjects receiving Engerix-B (*4*–*7*). The body of evidence for the benefits of protection against HBV infection was deemed to be GRADE evidence type 2 (i.e., evidence from randomized controlled trials with important limitations, or exceptionally strong evidence from observational studies). The evidence type was downgraded for indirectness because immunogenicity was used as a surrogate for protection.

Safety profiles among 9,871 subjects receiving 2 or 3 doses of HepB-CpG were compared with those among 4,385 subjects receiving 3 or 4 doses of Engerix-B. Among subjects receiving HepB-CpG, 45.6%, 5.4%, and 0.27% experienced a mild adverse event, serious adverse event, or cardiovascular event, respectively. Among subjects receiving Engerix-B, 45.7%, 6.3%, and 0.14% experienced a mild adverse event, serious adverse event, or cardiovascular event, respectively (*1*,*4*–*9*). The body of evidence assessing adverse events was deemed to be GRADE evidence type 1 (evidence from randomized controlled trials, or overwhelming evidence from observational studies).

Rationale

Based on the available immunogenicity evidence, a 2-dose schedule (0, 1 month) of HepB-CpG will be efficacious for the prevention of HBV infection. The risk for adverse events, including cardiovascular adverse events, was reviewed and will be monitored. The benefits of protection with 2 doses administered over 1 month make this an important option for prevention of HBV.

ACIP Recommendations

HepB-CpG may be used as a HepB vaccine in persons aged ≥18 years recommended for vaccination against HBV (Box) (*2*).

CDC Guidance for Use

Interchangeability and dosing schedule. Data are limited on the safety and immunogenicity effects when HepB-CpG is interchanged with HepB vaccines from other manufacturers. When feasible, the same manufacturer's vaccines should be used to complete the series (*10*). However, vaccination should not be deferred when the manufacturer of the previously administered vaccine is unknown or when the vaccine from the same manufacturer is unavailable (*10*).

The 2-dose HepB vaccine series only applies when both doses in the series consist of HepB-CpG. Series consisting of a combination of 1 dose of HepB-CpG and a vaccine from a different manufacturer should consist of 3 total vaccine doses and should adhere to the 3-dose schedule minimum intervals of 4 weeks between dose 1 and 2, 8 weeks between dose 2 and 3, and 16 weeks between dose 1 and 3. Doses administered at less than the minimum interval should be repeated. However, a series containing 2 doses of HepB-CpG administered at least 4 weeks apart is valid, even if the patient received a single earlier dose from another manufacturer.

Special populations. There are no clinical studies of HepB-CpG in pregnant women. Available human data on HepB-CpG administered to pregnant women are insufficient to inform assessment of vaccine-associated risks in pregnancy. Until safety data are available for HepB-CpG, providers should

BOX. Adults who are recommended to receive hepatitis B vaccine

- Persons at risk for infection through sexual exposure
  - Sex partners of hepatitis B surface antigen (HBsAg)–positive persons
  - Sexually active persons not in a long-term, mutually monogamous relationship
  - Persons seeking evaluation or treatment for a sexually transmitted infection
  - Men who have sex with men
- Persons with a history of current or recent injection drug use
- Persons at risk for infection by percutaneous or mucosal exposure to blood
  - Household contacts of HBsAg-positive persons
  - Residents and staff of facilities for developmentally disabled persons
  - Health care and public safety personnel with reasonably anticipated risk for exposure to blood or blood-contaminated body fluids
  - Hemodialysis patients and predialysis, peritoneal dialysis, and home dialysis patients
  - Persons with diabetes mellitus aged <60 years and persons with diabetes mellitus aged ≥60 years at the discretion of the treating clinician
- International travelers to countries with high or intermediate levels of endemic HBV infection (HBsAg prevalence ≥2%)
- Persons with hepatitis C virus infection, persons with chronic liver disease (including, but not limited to, those with cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, and an alanine aminotransferase [ALT] or aspartate aminotransferase [AST] level greater than twice the upper limit of normal)
- Persons with human immunodeficiency virus infection
- Incarcerated persons
- Other persons seeking protection from hepatitis B virus infection (even without acknowledgment of a specific risk factor)

continue to vaccinate pregnant women needing HepB vaccination with a vaccine from a different manufacturer.

Postvaccination serologic testing. To assess response to vaccination and the need for revaccination, postvaccination serologic testing 1–2 months after the final dose of vaccine is recommended for certain persons following vaccination (e.g., hemodialysis patients, HIV-infected and other immunocompromised persons, health care personnel, and sex partners of HBsAg-positive persons) (*2*). Postvaccination serologic testing should be performed using a method that allows determination of the protective level of anti-HBs (≥10 mIU/mL) (*2*). Persons with anti-HBs <10 mIU/mL following receipt of 2 doses of HepB-CpG should be revaccinated. Revaccination may consist of administration of a second complete HepB vaccine series followed by anti-HBs testing 1–2 months after the final dose. Alternatively, revaccination may consist of administration of an additional single HepB vaccine dose followed by anti-HBs testing 1–2 months later (and, if anti-HBs remains <10 mIU/mL, completion of the second HepB vaccine series followed again by anti-HBs testing 1–2 months after the final dose) (*2*). Administration of more than two complete HepB vaccine series is generally not recommended, except for hemodialysis patients (*2*). HepB-CpG may be used for revaccination following an initial HepB vaccine series that consisted of doses of HepB-CpG or doses from a different manufacturer (*11*). HepB-CpG may also be used to revaccinate new health care personnel (including the challenge dose) initially vaccinated with a vaccine from a different manufacturer in the distant past who have anti-HBs <10 mIU/mL upon hire or matriculation (*2*).

Precautions and contraindications. Before administering HepB-CpG, health care providers should consult the package insert for precautions, warnings, and contraindications. Adverse events occurring after administration of any vaccine should be reported to the Vaccine Adverse Event Reporting System (VAERS). Reports can be submitted to VAERS online, by fax, or by mail. Additional information about VAERS is available by telephone (1-800-822-7967) or online (https://vaers.hhs.gov).

Future Considerations

Postlicensure surveillance studies and additional data pertaining to the use of HepB-CpG will be reviewed by ACIP as they become available, and recommendations will be updated as needed. Future economic analyses might inform cost-effectiveness considerations of HepB-CpG, including its use among persons at an increased risk for vaccine nonresponse.

Conflict of Interest

No conflicts of interest were reported.

[1]Division of Viral Hepatitis, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC; [2]Pediatric Infectious Diseases Section, University of Arkansas for Medical Sciences and Arkansas Children's Hospital, Arkansas Children's Hospital Research Institute.

Corresponding author: Sarah Schillie, sschillie@cdc.gov, 404-718-8608.

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Notes from the Field

Surveillance for *Candida auris* — Colombia, September 2016–May 2017

Patricia Escandón[1,*]; Diego H. Cáceres[2,3,*]; Andres Espinosa-Bode[4]; Sandra Rivera[1]; Paige Armstrong[2]; Snigdha Vallabhaneni[2]; Elizabeth L. Berkow[2]; Shawn R. Lockhart[2]; Tom Chiller[2]; Brendan R. Jackson[2]; Carolina Duarte[1]

After a 2016 CDC alert describing infections caused by the multidrug-resistant fungus *Candida auris* (*1*), the Colombian Instituto Nacional de Salud (INS) queried the country's WHONET† database of invasive *Candida* isolates to detect previous *C. auris* infections. No *C. auris* isolates were identified during 2012–2016. However, *C. auris* is often misidentified as *Candida haemulonii* (*2*), a yeast that rarely causes invasive infections, and 75 *C. haemulonii* isolates were reported during May 2013–August 2016. These isolates came primarily from patients in intensive care units in the country's north region, approximately 350–600 km (220–375 miles) from Maracaibo, Venezuela, where *C. auris* cases were first identified in 2012 (*3*). Of the 75 reported Colombian *C. haemulonii* isolates in WHONET, INS obtained 45 isolates from six medical institutions dating from February 2015 through August 2016, all of which were confirmed to be *C. auris* by matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry. Based on these findings, INS issued a national alert and mandated reporting of suspected isolates on August 30, 2016§ (*3,4*). In September 2016, a team from INS, CDC, and medical staff members from hospitals with documented *C. auris* cases investigated the 45 MALDI-TOF–confirmed *C. auris* cases identified before the INS alert. This investigation involved two hospitals in the north region and two in the central region. Cases were clustered within specific hospital units, and surveillance sampling demonstrated transmission in health care settings (INS and CDC, unpublished data, 2018).

After release of the Colombian clinical alert, INS received suspected *C. auris* isolates for confirmatory testing, and during September 2016–May 2017, an additional 78 *C. auris* cases were identified from 24 health care facilities in nine states, resulting in a total of 123 confirmed *C. auris* cases (Figure), more than half (54.5%) recovered from the northern coastal region (Atlántico, Bolívar, and Cesar). The median age of all patients was 36 years (interquartile range = 2–62 years), and 75 (61%) were male. Children aged 0–18 years accounted for 39 (32%) cases, including 23 (19%) in infants aged <1 year. The majority (68; 56%) of cases were reported from the northern region, and 30 (24%) were reported from the central region. Isolates were recovered from blood (74; 60%), urine (11; 9%), respiratory specimens (10; 8%), the gastrointestinal tract (7; 5%), and other body fluids and body sites (8; 7%). For 13 (11%) cases, no information was available about the source of the *C. auris* isolate.

The VITEK 2 system had been used for yeast identification in 21 (75%) of 28 medical institutions. Four institutions used MicroScan (one), BD Phoenix (one), and Bruker MALDI-TOF Biotyper systems (two), and for three institutions, information about the identification method was not available. Six (4%) of 123 *C. auris* isolates were correctly identified, all by a clinical laboratory that used MALDI-TOF Biotyper (*2*). *C. auris* was most frequently misidentified as *C. haemulonii* (94; 76%), including 69 (97%) of 71 isolates identified by VITEK 2, all 23 isolates identified by BD Phoenix, and two of eight identified by MALDI-TOF Biotyper. Automated systems were unable to report a species for eight (7%) isolates (two by VITEK 2, four by MicroScan, and two by a system whose method was not reported). Thirteen *C. auris* isolates, all tested by MicroScan, were misidentified as other yeasts (*Candida albicans, Candida guilliermondii, Candida parapsilosis*, and *Rhodotorula rubra*).

Antifungal susceptibility testing was performed on 93 (76%) isolates¶ (*2,5*). Overall, 28 (30%) were resistant to fluconazole, 20 (22%) to amphotericin B, one (1%) to anidulafungin (an echinocandin), and one to both amphotericin B and anidulafungin.

Infections caused by *C. auris* are occurring in Colombia; the pathogen has been present in Columbia since at least 2015, and case counts are increasing. The number of reported cases likely does not reflect the true number of infected and colonized persons because of underreporting and underdiagnosis, as well as misdiagnosis as other yeast species (*6*). To contain the spread of *C. auris* in Colombia, INS updated the *C. auris* national clinical alert in July 2017 specifying which yeast isolates must be sent to INS for confirmation and mandating that medical facilities implement enhanced infection control

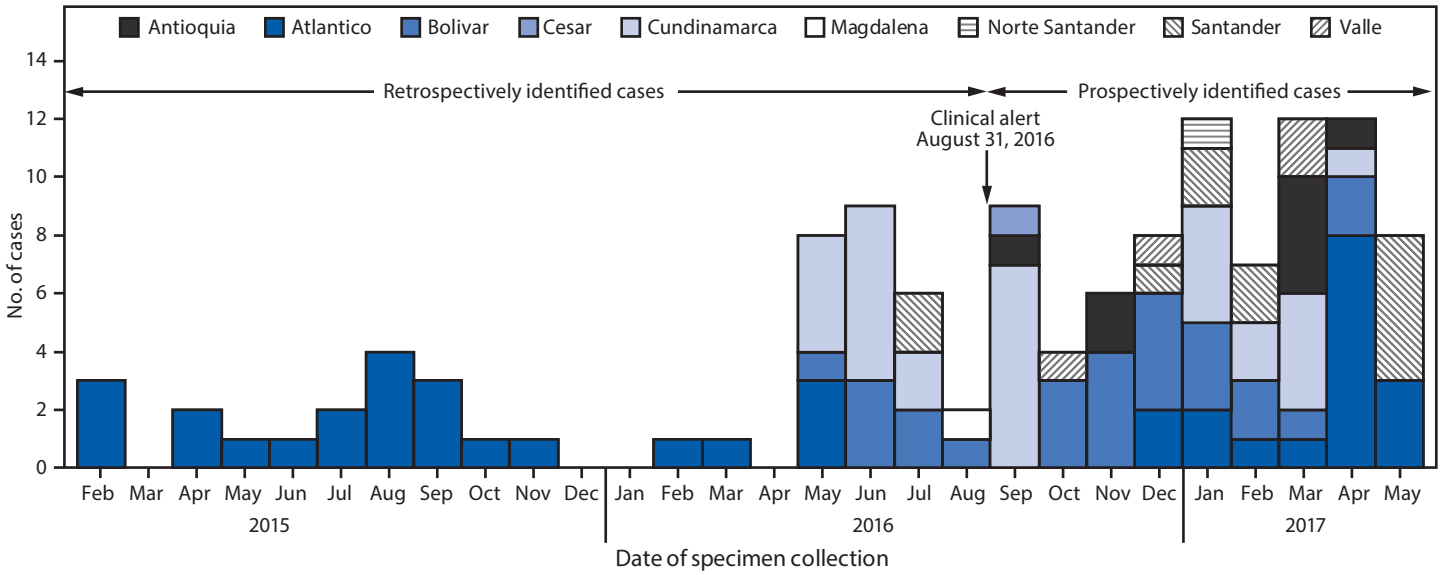
* These authors contributed equally.

† WHONET is a free software program developed by the World Health Organization (WHO) Collaborating Centre for Surveillance of Antimicrobial Resistance to support national surveillance activities in more than 120 countries (http://www.whonet.org/index.html).

§ https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/IA/INS/ins-alerta-colombia-candida-auris.pdf.

¶ The broth microdilution method was used for azoles and echinocandins and Etest for amphotericin B; susceptibility breakpoints used were those described by CDC.

FIGURE. Confirmed cases of *Candida auris*, by month and state (n = 123) — Colombia, February 2015–May 2017



practices, including using contact precautions and single rooms for patients with *C. auris* infections, minimizing the number of health care personnel in contact with infected patients, and daily and terminal cleaning of patient rooms and medical equipment with a disinfectant effective against *Clostridium difficile* spores** (*2*). Clinical laboratories should be aware that automated laboratory systems might incorrectly identify *C. auris*, particularly as *C. haemulonii*, although the species reported depends on the system (*2*).

** http://www.famisanar.com.co/wp-content/uploads/documentos/POS/Men%C3%BA%20Sivigila/Circulares%202017/Infecciones%20Invasivas_%200025%20DE%202017%20INS%20CANDIDA.pdf.

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Conflict of Interest

No conflicts of interest were reported.

[1]Grupo de Microbiología, Instituto Nacional de Salud, Bogotá, Colombia; [2]National Center for Emerging and Zoonotic Infectious Diseases, Office of Infectious Diseases, CDC; [3]Oak Ridge Institute for Science and Education (ORISE), Oak Ridge, Tennessee; [4]Division of Global Health Protection, Center for Global Health, CDC.

Corresponding author: Patricia Escandón, pescandon@ins.gov.co, 57-1-220-7700, ext. 1420.

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Erratum

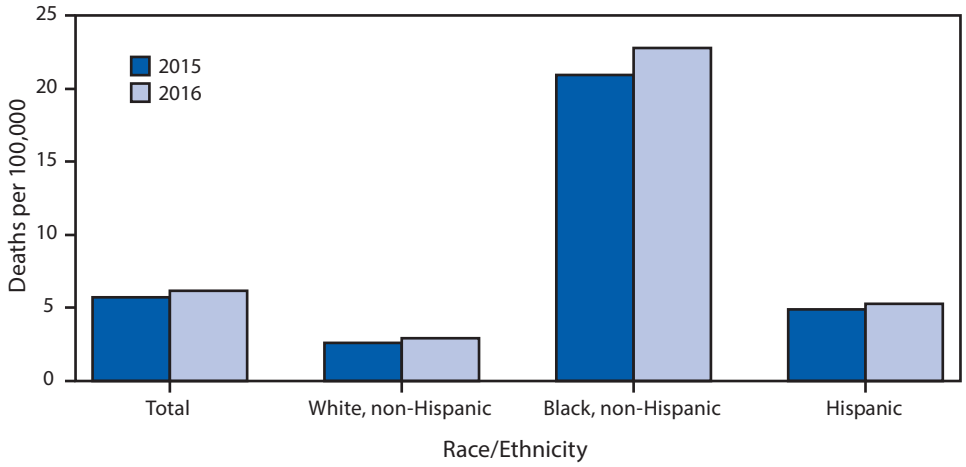
Vol. 67, No. 10

In the report "Notes from the Field: False-Negative Hepatitis B Surface Antigen Test Results in a Hemodialysis Patient — Nebraska, 2017," in the table on page 312, the testing instrument used by laboratory facility A should have read "**ADVIA Centaur XP.**"

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Homicide Rates,*,† by Race/Ethnicity — National Vital Statistics System, United States, 2015–2016



* Deaths per 100,000 population, age-adjusted to the 2000 U.S. standard population.
† As underlying cause of death, homicides are identified with the *International Classification of Diseases, Tenth Revision* codes X85–Y09 and Y87.1 and also codes U01–U02.

During 2015–2016, the age-adjusted homicide rate for the total population increased from 5.7 to 6.2 per 100,000 standard population (an 8.8% increase). The rate increased from 2.6 to 2.9 (11.5%) for non-Hispanic whites, from 20.9 to 22.8 (9.1%) for non-Hispanic blacks, and from 4.9 to 5.3 (8.2%) for Hispanics. In both years, the homicide rate for non-Hispanic blacks was approximately eight times the rate for non-Hispanic whites and four times the rate for Hispanics.

Source: National Vital Statistics System, underlying cause of death data, 1999–2016. https://wonder.cdc.gov/ucd-icd10.html.

Reported by: Jiaquan Xu, MD, jiaquanxu@cdc.gov, 301-458-4086.

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

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