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Marijuana Use Among 10th Grade Students — Washington, 2014

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Some studies have suggested that long-term, regular use of marijuana starting in adolescence might impair brain development and lower intelligence quotient (*1*,*2*). Since 2012, purchase of recreational or retail marijuana has become legal for persons aged ≥21 years in the District of Columbia, Alaska, California, Colorado, Maine, Massachusetts, Nevada, Oregon, and Washington, raising concern about increased marijuana access by youths. The law taxing and regulating recreational or retail marijuana was approved by Washington voters in 2012 and the first retail licenses were issued in July 2014; medical marijuana use has been legal since 1998. To examine the prevalence, characteristics, and behaviors of current marijuana users among 10th grade students, the Washington State Department of Health analyzed data from the state's 2014 Healthy Youth Survey (HYS) regarding current marijuana use. In 2014, 18.1% of 10th grade students (usually aged 15–16 years) reported using marijuana during the preceding 30 days; of these students, 32% reported using it on ≥10 days. Among the marijuana users, 65% reported obtaining marijuana through their peer networks, which included friends, older siblings, or at a party. Identification of comprehensive and sustainable public health interventions are needed to prevent and reduce youth marijuana use. Establishment of state and jurisdiction surveillance of youth marijuana use could be useful to anticipate and monitor the effects of legalization and track trends in use before states consider legalizing recreational or retail marijuana.

HYS is a cross-sectional, self-administered, pencil-and-paper survey that has been administered to Washington students in 6th, 8th, 10th, and 12th grades in public schools during the fall of even-numbered years since 2002. HYS uses a clustered sampling design in which public schools with at least 15 students in each grade are randomly selected and all students in eligible grades at participating schools are invited to complete the survey. The sample is representative of Washington public school students (*3*). To assess marijuana use prevalence, analysis was limited to students in 10th grade because of the grade-specific sampling nature of HYS and a sufficient sample size and response rate to allow for robust analysis (*3*).

Students were asked how many days during the past 30 days they had used marijuana. Current marijuana use was defined as use of marijuana on ≥1 day during the preceding 30 days. Percentages were calculated and bivariate analyses were performed to compare the prevalence of marijuana use by sex, race, Hispanic ethnicity, language spoken at home, and academic achievement. Prevalence of preceding 30-day marijuana use was estimated with 95% confidence intervals, and statistical significance was assessed using independent samples t-test comparison for sex, race, and Hispanic ethnicity, language spoken in home, and academic achievement. Bonferroni correction was used to restrict Type I error at 5% for race/ethnicity. To assess

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trends over time during 2002–2014, joinpoint regression* with a maximum number of joinpoints of "1" was used. To analyze use of various other substances, students were asked about past 30-day cigarette, e-cigarette, and alcohol use, and past 2-week binge drinking (defined for both males and females as consuming five or more drinks in a row).

Respondents also were asked how they obtained their marijuana with the following response options: "I did not get marijuana in the past 30 days," "I bought it from a store," "I got it from friends," "I got it from a party," "I got it from an older brother or sister," "I gave money to someone to get it for me," "I took it from home without my parents' permission," and "I got it from home with my parents' permission." Responses were combined for reporting peer network (i.e., friends, party, or sibling).

In 2014, a total of 192 schools (response rate = 87%) and 8,821 10th grade students (response rate = 66%) provided data for the analyses (*3*). Among the 8,821 students, 8,579 answered the marijuana question, 1,556 (18.1%) reported past 30-day marijuana use (Table 1) and that percentage did not change significantly during 2002–2014 (p = 0.214) (*3*). In 2014, past 30-day use prevalence was higher among 10th grade students who identified as non-Hispanic American Indian/Alaska Native (33.5%), non-Hispanic black (26.4%), and Hispanic (23.4%) than among students who identified as non-Hispanic white (17.2%) and non-Hispanic Asian (7.7%). There was no

TABLE 1. Number of 10th grade students surveyed and percentage who reported using marijuana on ≥1 of the preceding 30 days, by selected characteristics — Healthy Youth Survey, Washington, 2014

Characteristic	No. in sample* (%)	No. who reported marijuana use	Crude prevalence (95% CI)
Overall	**8,821 (100)**	**1,556**	**18.1 (16.6–19.8)**
Sex			
Male	4,263 (48.4)	782	19.0 (17.1–21.0)
Female	4,542 (51.6)	767	17.3 (15.6–19.1)
Race/Ethnicity			
White, non-Hispanic	4,919 (56.0)	829	17.2 (15.3–19.3)
Black, non-Hispanic	430 (4.9)	108	26.4 (22.2–31.1)
AI/AN, non-Hispanic	211 (2.4)	68	33.5 (27.2–40.4)
Asian, non-Hispanic	819 (9.3)	62	7.7 (6.0–9.7)
Pacific Islander, non-Hispanic	191 (2.2)	33	17.7 (13.1–23.6)
Hispanic	1,255 (14.3)	280	23.4 (21.0–25.9)
Other non-Hispanic	489 (5.6)	84	17.9 (15.0 – 21.3)
Multiracial non-Hispanic	468 (5.3)	90	19.8 (16.3 – 23.7)
Language usually spoken at home			
Non-English/All other	1,545 (18.0)	252	17.0 (14.7–19.5)
English	7,053 (82.0)	1256	18.2 (16.5–20.1)
School performance			
Mostly A and B grades	6,203 (73.6)	799	13.1 (11.6–14.7)
Mostly C, D, or F grades	2,230 (26.4)	699	32.3 (30.1–34.5)

Abbreviations: AI/AN = American Indian/Alaska Native; CI = confidence interval.
* A total of 242 responses were missing from the 8,821 10th grade students, reducing the denominator for overall marijuana use to 8,579. Denominators for the other categories might be < 8,579 because some participants only responded to the overall marijuana use question.

* https://surveillance.cancer.gov/joinpoint/index.html.

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difference in prevalence of marijuana use by sex or by language spoken at home. Prevalence of past 30-day marijuana use was higher among 10th graders who had poor school performance (32.3%) compared with students who reported mostly getting A or B grades (13.1%) (Table 1).

Approximately 37% of current 10th grade marijuana users reported using marijuana for 1–2 days during the preceding 30 days, and 32% reported using it for ≥10 days. More females than males reported marijuana use for 1–2 days (40.4% versus 33.6%) or 3–5 days (24.1% versus 15.5%), whereas more males than females reported marijuana use for ≥10 days during the past month (38.4% versus 26.2%).

The most commonly reported means of obtaining marijuana among 10th grade marijuana users was from peers (65%) or by giving someone money to purchase it (18%). Six percent of students reported purchasing marijuana from a store themselves, and 11% reported getting it from home with or without their parents' permission.

Greater percentages of marijuana users than nonmarijuana users reported smoking (combustible tobacco) cigarettes (30.6% versus 2.8%), drinking alcohol (64.3% versus 10.9%), and using e-cigarettes (61.7% versus 8.3%) during the preceding 30 days, and binge drinking during the preceding 2 weeks (38.3% versus 4.3%) (Table 2).

Discussion

Nationally, marijuana use among 10th grade students has been estimated at 15% to 24% (*4*,*5*). In 2014, 18.1% of Washington 10th grade students used marijuana at least once during the preceding 30 days, and this prevalence has been fairly consistent since 2002 (*3*). After Washington legalized recreational marijuana for persons aged ≥21 years in 2012, recreational or retail stores had opened by the summer of 2014; medical marijuana has been legal in the state since 1998.

Among Washington 10th grade students who reported using marijuana, about one third reported using it frequently (i.e., on ≥10 days in the past 30 days). School performance appears to be associated with marijuana use, as has been supported by previous studies (*6*); however, it cannot be determined from this study design if those with worse grades in school are just more likely to use marijuana or if marijuana is contributing to poor school performance. Most youths who are using marijuana are getting it from their peers, a finding that is similar for other substances (*7*). Moreover, 11% of students are getting marijuana from their own home. Educating adults and parents about the potential harms of marijuana use might be one potential strategy to help prevent youth marijuana initiation.

Approximately twice as many marijuana users reported using e-cigarettes (61.7%) than combustible cigarettes (30.6%). Some electronic cigarette devices can be used for either nicotine or marijuana, and reports have shown a recent increase in e-cigarette use (*8*). Tenth-grade marijuana users in Washington reported a higher prevalence of other substance use than nonmarijuana users. The use of more than one substance among marijuana users is concerning because all of the other substances in the survey have detrimental effects, and the interactive effects on youths are not well understood (*9*).

The findings in this report are subject to at least five limitations. First, data were collected only from youths attending public schools in Washington and might not be representative of all 10th grade students, although they are representative of the 93% of students who attend public schools. Second, data are self-reported and thus possibly subject to underreporting or overreporting of use of marijuana or other substances, including recall or response bias. Third, these estimates might differ from other nationally representative youth surveillance systems, in part because of differences in survey methods, survey type and topic, age and setting of target population, and time of year the survey was conducted. Fourth, HYS uses a five-drink cut-point for both males and females to define youth binge-drinking, which might result in underreporting of this behavior, because a four-drink limit is the standard for females.[†] Finally, medical marijuana was legalized in Washington in 1998, and the effects on marijuana prevalence among youths are not known because of a lack of historical (baseline) data before this legalization.

[†] https://www.cdc.gov/alcohol/fact-sheets/binge-drinking.htm.

TABLE 2. Prevalence of use of various other substances by 10th grade marijuana users compared with nonmarijuana users — Healthy Youth Survey, Washington 2014

Substance	No. (%) of respondents	No. of marijuana users	Crude prevalence of other substance use among marijuana users, % (95% CI)	No. of nonmarijuana users	Crude prevalence of other substance use among nonmarijuana users, % (95% CI)
Tobacco cigarettes	684 (7.9)	473	30.6 (26.9–34.5)	196	2.8 (2.3–3.4)
Alcohol	1,772 (20.6)	996	64.3 (61.3–67.1)	765	10.9 (10.0–11.8)
Binge drinking*	904 (10.6)	593	38.3 (35.6–41.1)	303	4.3 (3.7–5.1)
E-cigarettes	798 (17.8)	496	61.7 (56.6–66.5)	301	8.3 (7.0–9.8)

Abbreviation: CI = confidence interval.
* Consumed five or more alcoholic drinks in a row during the preceding 2 weeks.

Summary

What is already known about this topic?

Marijuana use among adolescents and young adults can impair brain development, lower intelligence quotient, and adversely affect development, including lower academic retention, social interaction and emotional development and other mental health effects. National surveys have been tracking marijuana use among youths. A number of states, including Washington, have legalized purchase of marijuana for recreational use among persons aged ≥21 years.

What is added by this report?

Approximately 18% of 10th grade students in Washington reported using marijuana at least 1 day during the preceding 30 days, and almost one third of these students used marijuana ≥10 days during the preceding 30 days. Prevalence of use differed by race and ethnicity and school performance and was highest among American Indian/Alaska Native students. The most common means of obtaining marijuana among the 10th graders was from their peers, and youths who use marijuana also were more likely to report alcohol and e-cigarette use than youths who do not use marijuana. Although recreational marijuana use was legalized in Washington in 2012 for persons aged ≥21 years, the prevalence of marijuana use among 10th graders did not change during 2002–2014.

What are the implications for public health practice?

Although national level estimates for marijuana use exist, state-level marijuana use along with detailed information on youth access is needed for states to develop effective intervention and prevention strategies aimed at youth marijuana use. As more states legalize medical and recreational marijuana, surveillance needs to be established to monitor trends in use by youths.

Regular marijuana use in adolescence is associated with impaired school performance and an increased risk for early school dropout (*6*). Preventing youth marijuana initiation and use can avoid harms associated with marijuana (*10*). As more states move to legalize marijuana for medical use or retail purchase, concerns about new and broader access to marijuana by youths are increasing. Although several successful strategies and recommendations are offered in the Community Preventive Services Task Force's Community Guide to reduce youth alcohol and tobacco use,[§] marijuana use is not a category in the Community Guide, which limits identifying and supporting implementation of strategies that are federally endorsed to reduce this behavior or prevent harms associated with marijuana use.

[§] https://www.thecommunityguide.org/.

Interventions and policies focused on reducing tobacco and alcohol use might be adapted for reducing marijuana use in states that have legalized sales, including limiting advertising and retailer density, enforcing minimum purchasing age, prohibiting public use of marijuana indoors and outdoors, conducting screening and brief interventions in medical settings, and increasing marijuana taxes and other price controls. Data on medical marijuana sales and diversion might also provide information regarding youth access. More research is needed to identify which programs and prevention strategies are most effective in reducing youth use and initiation of marijuana.

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Characteristics of Electronic Cigarette Use Among Middle and High School Students — United States, 2015

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Electronic cigarettes (e-cigarettes) are now the most commonly used tobacco product among U.S. youths (*1*,*2*); in 2015, 5.3% of middle school students and 16.0% of high school students reported using e-cigarettes in the past 30 days (*1*). However, limited information exists on the e-cigarette product types and brands used and the substances used in these products by youths. CDC and the Food and Drug Administration (FDA) analyzed data from the 2015 National Youth Tobacco Survey (NYTS) to examine the characteristics of e-cigarette use among U.S. middle (grades 6–8) and high (grades 9–12) school students in 2015, including types of products used, brands of products used, and whether substances other than nicotine were used with the products. Among respondents reporting ever having used an e-cigarette, 14.5% used only disposable e-cigarettes, 53.4% used only rechargeable/refillable e-cigarettes, and 32.1% used both types. Two of the most commonly used e-cigarette brands were blu (26.4%, 1.65 million youths) and VUSE (12.2%, 760,000 youths); half of students (50.7%, 3.18 million) did not know the brand of e-cigarette they used. One third (32.5%) of those who reported ever using an e-cigarette also reported having used e-cigarettes for substances other than nicotine. Preventing youths from beginning use of any tobacco product, including e-cigarettes, is critical to tobacco use prevention and control strategies in the United States (*3*). Monitoring the characteristics of e-cigarette use among youths, including product types, brands, and ingredients, is important to inform strategies to prevent and reduce e-cigarette use among youths.

The NYTS is a cross-sectional, school-based, self-administered, pencil-and-paper questionnaire administered to U.S. middle and high school students.* A three-stage cluster sampling procedure was used to generate a nationally representative sample of U.S. students attending public and private schools in grades 6–12. In 2015, 17,711 students completed the NYTS; the response rate was 63.4%.

The analytic sample included 4,021 students who reported ever using e-cigarettes, even once or twice.† Respondents were asked what types of e-cigarettes they had used (disposable, rechargeable/refillable, or both), what brands of e-cigarettes they had ever tried (blu, NJOY, MarkTen, Logic, VUSE, Finiti, Starbuzz, Fantasia, some other brand not listed, or don't know), and if they had ever used an e-cigarette for any substance other than nicotine (yes or no).§ Data were weighted to account for the complex survey design and to adjust for nonresponse. Among e-cigarette users, prevalence estimates and 95% confidence intervals are reported for type of e-cigarette ever used, brands, and whether e-cigarettes were used for any substance other than nicotine. Estimates were calculated overall and by school level (middle or high), sex, and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic other). Population estimates rounded down to the nearest 10,000 were also computed. Estimates with a relative standard error greater than 30% were not reported.

In 2015, 13.5% of middle and 37.7% of high school students had ever used an e-cigarette. Among all students reporting having ever used an e-cigarette, 14.5% had used only disposable e-cigarettes, 53.4% had used only rechargeable/refillable e-cigarettes, and 32.1% had used both types (Table). Use of both types of e-cigarettes was higher among males compared with females, and non-Hispanic white and Hispanic students compared with non-Hispanic black students.

Among students who had ever used an e-cigarette, approximately half (50.7%, 3.18 million) did not know the brand of e-cigarette they had used. The most commonly reported e-cigarette brand was blu (26.4%, 1.65 million), followed by "other" brands (24.2%, 1.52 million); VUSE (12.2%, 760,000); Starbuzz (5.0%, 310,000); Logic (4.6%, 280,000); NJOY (4.5%, 270,000); Fantasia (4.1%, 250,000); MarkTen (2.2%, 140,000); and Finiti (1.4%, 90,000) (Figure).

Approximately one third of students who had ever used an e-cigarette (32.5%) reported having used (at least once) an e-cigarette for a substance other than nicotine (Table). Use of e-cigarettes for a substance other than nicotine was higher among males compared with females, and non-Hispanic white and Hispanic students compared with non-Hispanic black students. The proportion of e-cigarette users who used an e-cigarette for a substance other than nicotine was similar among middle (33.7%) and high (32.2%) school students.

* https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm.

† Respondents with missing responses for any measure included in the analysis (n = 652) were excluded from the sample.

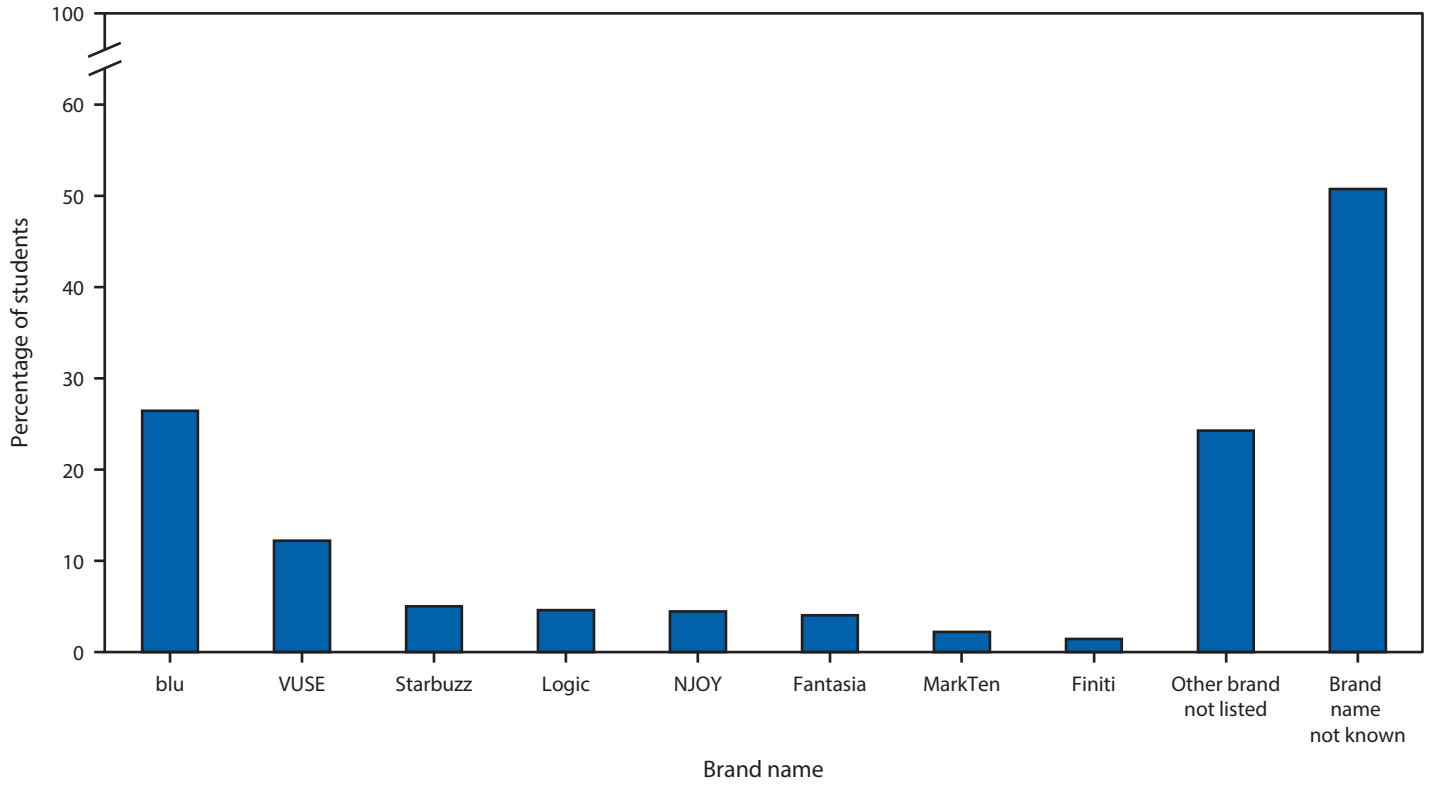
§ The wording on the survey instrument was as follows: "Thinking about all types of electronic cigarettes or e-cigarettes, have you used the disposable kind or rechargeable/refillable tank kind?"; "What brands of electronic cigarettes or e-cigarettes have you ever tried? (CHOOSE ALL THAT APPLY)"; "Have you ever used an electronic cigarette device for any other substance other than for nicotine?"

TABLE. Percentages of middle and high school students who reported ever using an e-cigarette, including using an e-cigarette for a substance other than nicotine, by type and brand of e-cigarette, sex, and race/ethnicity — United States, 2015*

		Sex		Race/Ethnicity			
	Total	Male	Female	Non-Hispanic white	Non-Hispanic black	Hispanic	Non-Hispanic other
Characteristic	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Type							
Only disposable	**14.5 (12.3–17.0)**	13.7 (11.3–16.6)	15.4 (12.6–8.7)	11.3 (9.2–13.7)	24.1 (18.0–31.5)	18.3 (15.1–22.0)	12.6 (8.5–18.2)
Only rechargeable/refillable	**53.4 (50.2–56.6)**	52.2 (48.7–55.8)	54.8 (50.9–58.6)	54.2 (50.8–57.6)	57.6 (50.7–64.2)	49.1 (43.7–54.4)	59.6 (52.2–66.5)
Both	**32.1 (29.9–34.3)**	34.0 (31.0–37.2)	29.8 (27.2–32.6)	34.5 (31.6–37.6)	18.3 (14.6–22.8)	32.6 (28.7–36.8)	27.9 (22.2–34.3)
Brand†							
blu	**26.4 (23.9–29.1)**	28.1 (24.9–31.6)	24.4 (21.5–27.5)	25.7 (22.5–29.1)	35.4 (29.7–41.6)	25.3 (21.4–29.6)	22.5 (15.6–31.2)
VUSE	**12.2 (10.6–13.9)**	13.5 (11.2–16.1)	10.7 (9.0–12.6)	12.2 (10.3–14.3)	11.9 (8.0–17.4)	12.5 (10.0–15.6)	11.2 (8.2–15.2)
NJOY, MarkTen, Logic, Finiti, Starbuzz, and/or Fantasia§	**14.9 (13.5–16.4)**	16.2 (14.1–18.4)	13.4 (11.8–15.2)	14.4 (12.5–16.5)	11.4 (8.4–15.3)	17.4 (14.6–20.6)	14.4 (11.0–18.6)
Other brand not listed on questionnaire	**24.2 (22.3–26.3)**	29.5 (26.6–32.5)	18.1 (16.2–20.1)	25.8 (23.5–28.3)	17.2 (12.3–23.5)	21.3 (18.3–24.6)	36.5 (27.7–46.3)
Did not know the brand name	**50.7 (48.3–53.0)**	44.4 (41.6–47.3)	58.1 (55.2–60.9)	50.9 (47.9–53.8)	45.4 (38.5–52.5)	53.4 (49.0–57.7)	43.9 (37.5–50.5)
Ever used e-cigarette for substance other than nicotine							
Yes	**32.5 (30.2–34.9)**	36.9 (34.0–40.0)	27.2 (24.6–29.9)	32.6 (30.0–35.4)	26.0 (19.5–33.9)	33.7 (30.3–37.4)	36.9 (29.1–45.4)
No	**67.5 (65.1–69.8)**	63.1 (60.0–66.0)	72.8 (70.1–75.4)	67.4 (64.6–70.0)	74.0 (66.1–80.5)	66.3 (62.6–69.7)	63.1 (54.6–70.9)
Middle school							
Type							
Only disposable kind	**17.8 (13.5–22.9)**	17.2 (12.0–24.0)	18.5 (14.3–23.6)	13.6 (10.0–18.2)	28.7 (20.6–38.4)	20.7 (14.1–29.4)	—¶
Only rechargeable/refillable kind	**61.0 (55.5–66.2)**	61.4 (54.0–68.2)	60.5 (54.1–66.6)	62.8 (56.6–68.6)	57.3 (46.6–67.4)	59.4 (48.8–69.2)	60.8 (46.3–73.5)
Both	**21.3 (17.8–25.2)**	21.5 (16.7–27.1)	21.0 (16.6–26.2)	23.6 (18.9–29.1)	14.0 (8.3–22.7)	19.9 (14.4–26.8)	22.6 (13.2–35.9)
Brand†							
blu	**29.4 (25.0–34.3)**	32.4 (27.5–37.8)	25.7 (20.1–32.2)	26.5 (20.7–33.2)	44.8 (34.6–55.4)	28.9 (21.8–37.3)	28.7 (17.7–43.1)
VUSE	**14.0 (11.7–16.8)**	15.6 (12.1–19.9)	12.0 (9.1–15.7)	12.9 (9.7–16.9)	15.6 (8.4–27.1)	15.2 (11.1– 20.4)	15.1 (8.2–26.1)
NJOY, MarkTen, Logic, Finiti, Starbuzz, and/or Fantasia§	**14.6 (12.1–17.5)**	14.4 (11.6–17.7)	14.8 (11.0–19.7)	12.8 (10.4–15.7)	—¶	19.2 (14.3–25.4)	—¶
Other brand not listed on questionnaire	**19.6 (16.7–22.8)**	21.3 (17.3–25.8)	17.4 (13.7–21.8)	20.4 (15.9–25.8)	—¶	18.6 (13.6–24.9)	25.3 (14.4–40.4)
Didn't know brand	**47.6 (44.3–50.9)**	43.6 (38.8–48.6)	52.7 (47.7–57.6)	50.3 (45.8–54.9)	36.8 (25.6–49.7)	46.9 (41.1–52.9)	48.2 (32.1–64.6)
Ever used e-cigarette for substance other than nicotine							
Yes	**33.7 (29.2–38.4)**	35.6 (30.7–40.9)	31.2 (25.5–37.4)	31.8 (25.6–38.8)	22.3 (14.4–32.8)	39.4 (33.4–45.7)	42.5 (25.8–61.1)
No	**66.3 (61.6–70.8)**	64.4 (59.1–69.3)	68.8 (62.6–74.5)	68.2 (61.2–74.4)	77.7 (67.2–85.6)	60.6 (54.3–66.6)	57.5 (38.9–74.2)
High School							
Type							
Only disposable kind	**13.6 (11.3–16.4)**	12.8 (10.2–15.9)	14.6 (11.3–18.7)	10.7 (8.3–13.7)	22.7 (16.1–30.9)	17.5 (14.1–21.5)	11.6 (7.6–17.2)
Only rechargeable/refillable kind	**51.4 (48.0–54.8)**	49.7 (46.2–53.3)	53.4 (48.9–57.8)	52.2 (48.5–56.0)	57.6 (49.9–65.0)	45.6 (40.3–51.1)	59.3 (51.4–66.7)
Both	**34.9 (32.5–37.5)**	37.5 (34.1–0.9)	32.0 (28.8–35.4)	37.1 (33.7–40.5)	19.7 (14.8–25.6)	36.9 (32.8–41.1)	29.1 (22.9–36.3)
Brand†							
blu	**25.6 (22.6–28.8)**	27.0 (23.1–31.2)	24.0 (20.6–27.9)	25.5 (21.5–30.0)	32.6 (26.9–38.8)	24.1 (19.9–28.8)	21.0 (13.2–31.8)
VUSE	**11.7 (10.0–13.7)**	12.9 (10.3–16.0)	10.4 (8.5–12.6)	12.0 (9.8–14.6)	10.8 (6.8–16.8)	11.6 (8.8–15.2)	10.3 (6.9–15.1)
NJOY, MarkTen, Logic, Finiti, Starbuzz, and/or Fantasia§	**15.0 (13.3–16.8)**	16.6 (14.3–19.2)	13.0 (11.3–15.0)	14.7 (12.5–17.2)	12.0 (8.6–16.5)	16.8 (13.4–20.9)	14.4 (10.2–19.9)
Other brand not listed on questionnaire	**25.5 (23.3–27.8)**	31.7 (28.4–35.1)	18.2 (16.2–20.4)	27.1 (24.5–29.7)	17.4 (12.2–24.4)	22.2 (18.5–26.4)	39.2 (29.3–50.0)
Didn't know brand	**51.5 (48.8–54.2)**	44.6 (41.4–47.9)	59.5 (56.1–62.8)	51.0 (47.3–54.7)	48.0 (40.7–55.4)	55.5 (50.4–60.6)	42.9 (35.4–50.8)
Ever used e-cigarette for substance other than nicotine							
Yes	**32.2 (29.9–34.5)**	37.3 (34.3–40.4)	26.2 (23.4–29.1)	32.8 (30.3–35.5)	27.2 (20.5–35.2)	31.9 (28.4–35.5)	35.5 (26.5–45.7)
No	**67.8 (65.5–70.1)**	62.7 (59.6–65.7)	73.8 (70.9–76.6)	67.2 (64.5–69.7)	72.8 (64.8–79.5)	68.1 (64.5–71.6)	64.5 (54.3–73.5)

* Respondents with missing data for any demographic or analysis variable and respondents who reported never e-cigarette use on the brand or type question were excluded from the analysis.
† Categories are not mutually exclusive.
§ Because of small sample sizes, estimates for these six e-cigarette brands were combined into one category.
¶ Relative standard error >30.

FIGURE. Percentages of middle and high school students who reported ever using e-cigarettes, by brand of e-cigarette used* — United States, 2015



* Categories are not mutually exclusive.

Discussion

Among middle and high school students who have ever used e-cigarettes, most report using rechargeable/refillable e-cigarettes, and approximately one third report having used e-cigarettes for substances other than nicotine. Among students who have ever used an e-cigarette, the most commonly reported brand was blu; approximately half of students did not know the brand of e-cigarettes they have used. Tobacco use and addiction typically begin during adolescence (*3*,*4*), and the U.S. Surgeon General has concluded that the use of products containing nicotine in any form among youth, including in e-cigarettes, is unsafe (*5*). Comprehensive and sustained strategies are critical to prevent and reduce the use of e-cigarettes among U.S. youths (*5*).

Most e-cigarette users (53.4%) reported using a rechargeable/refillable e-cigarette, 32.1% used both rechargeable/refillable and disposable devices, and 14.5% used a disposable device only. Disposable e-cigarettes are often similar in size and shape to conventional cigarettes; rechargeable/refillable e-cigarettes, which come in various shapes and sizes, can be readily customized by the user to include various levels of nicotine, flavors, and other ingredients. In addition, refillable e-cigarettes come in multiple device types with a range of possible voltages and other characteristics that can affect the heating of the e-liquid, release of nicotine, and formation of toxicants (*5*). Variations in the efficiency of nicotine delivery might affect the products' addiction risk (*6*). Because e-cigarettes are the most commonly used tobacco product among middle and high school students, and nicotine exposure from any source is harmful for youths (*5*), it is critical that comprehensive tobacco control and prevention strategies address the diversity of e-cigarette products used by U.S. youths.

Most students did not know the brand of e-cigarettes they used. Among those who did know the brand of e-cigarettes they used, blu and VUSE were the most commonly reported brands. The higher reported use of blu and VUSE products might be explained, in part, by the fact that they are owned by large cigarette manufacturers, and thus, are among the most heavily advertised e-cigarette brands in the United States (*7*). Approximately 70% of U.S. middle and high school students are exposed to e-cigarette advertising (*8*), and youths' exposure to e-cigarette advertising is associated with current use (*5*). Moreover, certain e-cigarette marketers are using advertising tactics similar to those used in the past to market conventional cigarettes, employing themes and imagery conveying independence, rebellion, and sexual attractiveness (*5*). The unrestricted

marketing of e-cigarettes could contribute to increasing use of these products among youths (*5*) and has the potential to undermine progress in preventing tobacco product use and promoting a tobacco-free lifestyle among youths (*3*,*5*).

Approximately one third of students reported using e-cigarettes for substances other than nicotine. This aligns with previous research, including one study of Connecticut high school students, in which 18.0% of those who had ever used an e-cigarette reported using cannabis in an e-cigarette (*9*). The present study's finding suggests that the remaining majority of users have used e-cigarettes to consume nicotine. In contrast, a recent study using a different self-reported measure found that between 13% and 22% of students in grades 8, 10, and 12 who had ever used an e-cigarette reported using nicotine the last time they had used an e-cigarette (*10*). In the present analysis, it is unknown whether students who had used an e-cigarette for a non-nicotine substance had also used an e-cigarette for nicotine, which might underestimate nicotine use. Additional research is warranted on the presence of nicotine in e-cigarettes, including from data sources that might not be subject to the same limitations as self-reported data among youth, such as retail sales data (*5*). Nicotine content in e-cigarettes is of public health concern because exposure to nicotine is the main cause of tobacco product dependence (*3*), and nicotine exposure during adolescence, a critical period for brain development, can cause addiction, can harm brain development, and could lead to sustained tobacco product use among youths (*3*,*5*).

The findings in this report are subject to at least five limitations. First, NYTS samples middle and high school students from public and private schools in the United States; therefore, these findings might not be generalizable to youths who are home-schooled, have dropped out of school, or are in detention centers. Second, data were self-reported; thus, the findings are subject to bias. Third, not all brands of e-cigarettes were assessed; one fourth of students reported having used brands not mentioned in the questionnaire. Fourth, response bias might have affected the results because the NYTS response rate in 2015 was 63.4%. Finally, it was not possible to ascertain the specific substances used by students reporting that they had used a substance other than nicotine in an e-cigarette.

Comprehensive and sustained strategies are warranted to prevent and reduce the use of all tobacco products, including e-cigarettes, among U.S. youths (*3*,*5*). Regulation of the manufacturing, distribution, and marketing of tobacco products by FDA,[¶] coupled with full implementation of comprehensive tobacco control and prevention strategies at CDC-recommended funding levels, could reduce youths' e-cigarette use and initiation (*3*,*5*). In addition, monitoring the characteristics of e-cigarette use among youths, including product types, brands, and ingredients, is important to guide measures to prevent and reduce use of e-cigarettes among youths.

[¶] https://www.federalregister.gov/a/2016-10685.

Summary

What is already known about this topic?

In 2015, e-cigarettes were the most commonly used tobacco product among U.S. middle and high school students. Tobacco use and addiction typically begin during adolescence, and the use of products containing nicotine in any form among youth, including in e-cigarettes, is unsafe.

What is added by this report?

Among U.S. middle and high school students who have ever used e-cigarettes, most report using rechargeable/refillable e-cigarettes, and approximately one third report using e-cigarettes for substances other than nicotine. Among students who reported ever using e-cigarettes, the most commonly reported brand was blu (26.4%, 1.65 million youths); approximately half of students did not know the brand of e-cigarettes they have used.

What are the implications for public health practice?

Comprehensive and sustained strategies are warranted to prevent and reduce the use of all tobacco products, including e-cigarettes, among U.S. youths. Monitoring the characteristics of e-cigarette use among youths, including product types, brands, and ingredients, is important to guide measures to prevent and reduce the use of e-cigarettes among youths.

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Outbreak of *Salmonella* Oslo Infections Linked to Persian Cucumbers — United States, 2016

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In April 2016, PulseNet, the national molecular subtyping network for foodborne disease surveillance, detected a multistate cluster of *Salmonella enterica* serotype Oslo infections with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern (*Xba*I PFGE pattern OSLX01.0090).* This PFGE pattern was new in the database; no previous infections or outbreaks have been identified. CDC, state and local health and agriculture departments and laboratories, and the Food and Drug Administration (FDA) conducted epidemiologic, traceback, and laboratory investigations to identify the source of this outbreak. A total of 14 patients in eight states were identified, with illness onsets occurring during March 21–April 9, 2016. Whole genome sequencing, a highly discriminating subtyping method, was used to further characterize PFGE pattern OSLX01.0090 isolates. Epidemiologic evidence indicates Persian cucumbers as the source of *Salmonella* Oslo infections in this outbreak. This is the fourth identified multistate outbreak of salmonellosis associated with cucumbers since 2013. Further research is needed to understand the mechanism and factors that contribute to contamination of cucumbers during growth, harvesting, and processing to prevent future outbreaks.

Epidemiologic Investigation

State and local public health officials in Minnesota and Michigan initiated an investigation when four persons with *Salmonella* Oslo infections were identified. A case was defined as infection with *Salmonella* Oslo with PFGE pattern OSLX01.0090 (the outbreak strain) in a person with illness onset occurring during March 21–April 9, 2016. Most people infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12–72 hours after infection. Initial interviews of ill persons found that shopping at a national chain grocer (chain A) and purchasing produce was commonly reported. A structured, focused supplemental questionnaire was developed to collect detailed information on exposure to grocery stores and produce, including cucumbers and leafy greens, in the 7 days before illness onset. Exposure frequencies were compared with the 2006–2007 FoodNet Population Survey, in which healthy persons reported foods consumed in the week before interview.† Information also was collected on illness subclusters, defined as two or more unrelated ill persons who reported eating at the same restaurant, attending the same event, or shopping at the same grocery store in the week before becoming ill.

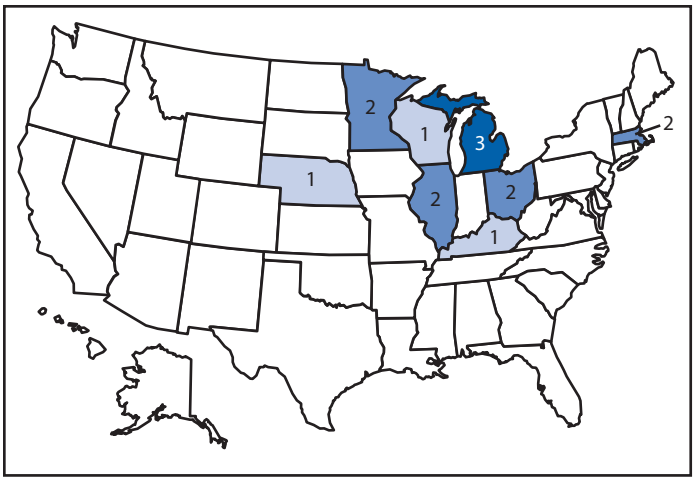
A total of 14 cases were reported from eight states§ (Figure 1). Illness onset dates ranged from March 21–April 9, 2016 (Figure 2). Median age of patients was 36 years (range = 3–68 years); nine were female. Three patients were hospitalized; no deaths were reported. Thirteen patients were interviewed using the supplemental questionnaire about exposures in the week before illness onset, of whom 12 reported eating cucumbers in the week before becoming ill. Patients were significantly more likely to report consuming cucumbers compared with the 2006–2007 FoodNet Population Survey, in which 46.9% of respondents reported consuming cucumbers in the week before interview ($p<0.001$). Among the 12 patients who consumed cucumbers, 11 specifically reported Persian or "mini" cucumbers, which are small, seedless cucumbers with smooth skin. Eight of 13 respondents reported purchasing their cucumbers from chain A. The proportion of ill persons who reported eating fruit, leafy greens, or any other item on the supplemental questionnaire was not significantly higher than expected when compared with the FoodNet Population Survey.

Traceback Investigation

FDA, the Canadian Food Inspection Agency, and officials in Minnesota, Massachusetts, and Michigan collaborated to conduct an informational traceback investigation from retail establishments in these states to identify the source of the cucumbers. Informational traceback can support the epidemiologic investigation by quickly assessing the plausibility of one or more vehicles as the source of the outbreak. Informational traceback typically can be completed much more quickly than regulatory traceback, which requires the collection of specific types of records, such as receipts and invoices, at each step of the distribution chain. Factors used to identify the best *Salmonella* Oslo cases for traceback included confirmed cucumber purchase information, geographic diversity, and diversity of establishments (grocery stores and cucumber suppliers). In addition, an informational traceback was conducted from points of service for patients with reported cucumber

* http://www.cdc.gov/pulsenet.
† http://www.cdc.gov/foodnet/studies/population-surveys.html.
§ Illinois, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, Ohio, and Wisconsin.

FIGURE 1. Number of persons (n = 14) infected with the outbreak strain of *Salmonella* Oslo, March 2–April 9, 2016



exposures, but without supporting shopper records or receipts. The investigation identified two Canadian Persian cucumber suppliers during the timeframe of interest, but a single grower was not identified. Growers who could have supplied these cucumbers were located in Canada, Mexico, and the Dominican Republic. These Canadian-grown cucumbers would have also been distributed in Canada and no reported clinical cases matching the U.S. outbreak pattern were identified. Only one illness subcluster was identified (in Minnesota), involving two unrelated persons who shopped at the same grocery store and purchased the same brand of Persian cucumbers on the same day. During the informational traceback, it was found that cases in Minnesota and Massachusetts had purchased the same brand of cucumbers from both chain A and a separate chain grocer (chain B). Additional cases from other states also reported purchasing Persian cucumbers from chain A, but could not remember the brand. Further traceback revealed that the cucumbers purchased at both of these chain grocers were sourced from a common produce supplier. These findings indicate that although the majority of patients purchased cucumbers from chain A, chain A was unlikely to be the only venue at which contaminated cucumbers were sold. Chain A voluntarily removed all Persian cucumber products from their shelves while the investigation and traceback efforts were ongoing.

Laboratory Investigation

Cucumber samples were collected from the point of sale, from patients' homes, and from one of the Canadian suppliers, approximately 1 month after the patients' purchase date, but no cucumbers yielded *Salmonella*.

Whole genome sequencing was performed on four clinical isolates by state health departments and CDC to further characterize the genetic relatedness of bacteria isolated from patients. High quality single nucleotide polymorphism (hqSNP) analysis revealed all four clinical isolates from cases in Michigan and Ohio were highly related (differing by 0–1 SNPs).

Summary

What is already known about this topic?

Salmonella is the most common bacterial cause of foodborne disease in the United States and results in the highest number of hospitalizations and deaths among foodborne pathogens. The Oslo serotype is rare, with about 25 cases reported each year nationally. According to the National Outbreak Reporting System, *Salmonella* outbreaks associated with cucumbers have been increasing in number each year since 2010.

What is added by this report?

In April 2016, a multistate cluster of *Salmonella enterica* serotype Oslo infections with an indistinguishable pulse-field gel electrophoresis pattern (*Xba*I PFGE pattern OSLX01.0090) was detected, involving 14 patients in eight states with illness onsets occurring during March 21–April 9. Epidemiologic evidence suggested that Persian cucumbers were the source of the outbreak; however, *Salmonella* was not isolated from any cucumbers.

What are the implications for public health practice?

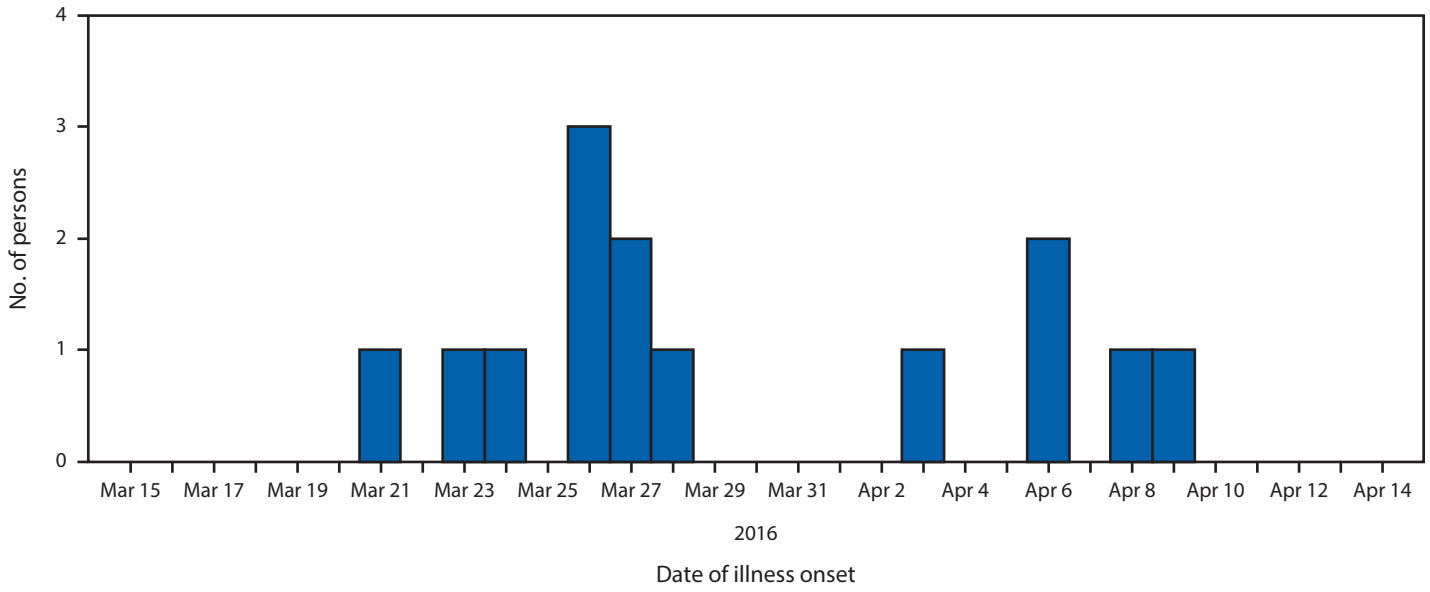
Cucumbers have been identified as the source of several recent multistate outbreaks of *Salmonella* infections. As a consequence of these outbreaks, the Food and Drug Administration has selected cucumbers for an enhanced microbiologic surveillance sampling program for FY2016, in which both imported and domestic cucumbers will be tested for *Salmonella* and other pathogens. This program will assess whether any common factors are associated with *Salmonella* contamination. Implementation of new Food Safety Modernization Act requirements intended to prevent and minimize contamination of produce with pathogens might help to prevent or minimize future cucumber-associated *Salmonella* outbreaks.

Discussion

Salmonella is the most common bacterial cause of foodborne disease in the United States and results in the highest number of hospitalizations and deaths among foodborne pathogens (*1*). Epidemiologic data indicate that Persian cucumbers were the source of *Salmonella* Oslo infections in this outbreak. Cucumbers were the only food eaten by patients significantly more often than expected. Further, most ill persons purchased a specific variety of cucumbers (Persian) from a single grocery chain. However, investigation into the source of these cucumbers did not find a common grower or other potential point of contamination.

This report highlights some of the inherent difficulties associated with outbreak investigations in which relatively short shelf life produce items are suspected. Given that the typical shelf life of cucumbers is 10–14 days, suspected cucumbers

FIGURE 2. Date of illness onset among 14 persons infected with the outbreak strain of *Salmonella* Oslo — 8 states,* March 21–April 9, 2016



* Illinois, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, Ohio, and Wisconsin.

were no longer available in homes at the time ill persons were interviewed. In addition, *Salmonella* was not isolated from any cucumbers collected from ill persons or grocery stores, although the samples collected from points of sale and distribution might not have originated from the same farm as those consumed by persons before illness onset. However, despite being unable to test cucumbers earlier and find the outbreak strain of *Salmonella*, the epidemiologic evidence pointing to Persian cucumbers as the source of the outbreak was strong.

This is the fourth *Salmonella* outbreak since 2013 associated with cucumbers, with over 1,200 illnesses and 260 hospitalizations included in the previous three outbreaks (*2*–*4*). Two of these outbreaks were caused by cucumbers sourced from Mexico (*2*,*4*), whereas the other outbreak identified cucumbers sourced from Maryland as a major cause of illnesses (*3*). This outbreak supports the continued evaluation and sampling of produce by FDA with the Food Safety Modernization Act requirements intended to prevent and minimize contamination of produce with pathogens.[¶] Because the prevalence of *Salmonella* in cucumbers is unknown, FDA has initiated an enhanced sampling program for both domestic and imported whole, fresh, raw cucumbers within fiscal year 2016. The data (approximately 380 domestic cucumber samples and more than 1,200 imported cucumber samples) will suggest whether any common factors, such as season, region, and whether the product was produced domestically or imported, are associated with *Salmonella* contamination.

Recent outbreaks have used industry consultations to help provide clues to focus the investigation, so information about cucumber harvesting and distribution was readily available. Early identification and prompt investigation of this outbreak while it was still occurring was important because it enabled investigators to present evidence to chain A, a national grocer. Chain A's swift action to remove all Persian cucumber products, in addition to the short shelf life of cucumbers, likely contributed to the small size and short duration of this outbreak. Quick action by industry is essential to control future outbreaks. Continued communication between state and federal agencies and implicated retail locations and industry can also enhance the timeliness of response to effectively end outbreaks.

Consumers and retailers should always follow safe produce handling recommendations.[**] Cucumbers, like most produce, should be washed thoroughly, scrubbed with a clean produce brush before peeling or cutting, and refrigerated as soon as possible to prevent multiplication of bacteria such as *Salmonella*.

[¶] http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm361902.htm.

[**] http://www.foodsafety.gov/keep/types/fruits/tipsfreshprodsafety.html.

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CDC Grand Rounds: Chronic Fatigue Syndrome — Advancing Research and Clinical Education

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Chronic fatigue syndrome (CFS) is a complex and serious illness that is often misunderstood. Experts have noted that the terminology "chronic fatigue syndrome" can trivialize this illness and stigmatize persons who experience its symptoms (*1*). The name was coined by a group of clinicians convened by CDC in the late 1980s to develop a research case definition for the illness, which, at the time, was called chronic Epstein-Barr virus syndrome. The name CFS was suggested because of the characteristic persistent fatigue experienced by all those affected and the evidence that acute or reactivated Epstein-Barr virus infection was not associated with many cases (*2*). However, the fatigue in this illness is striking and quite distinct from the common fatigue everyone experiences. A variety of other names have been used, including myalgic encephalomyelitis (ME), ME/CFS, chronic fatigue immune dysfunction, and most recently, systemic exertion intolerance disease (*3*). The lack of agreement about nomenclature need not be an impediment for advancing critically needed research and education. The term ME/CFS will be used in this article.

ME/CFS is a Significant Public Health Problem

Extrapolating from the three U.S. population-based studies, it is estimated that at least one million persons in the United States suffer from ME/CFS (*4–6*). These studies indicate that ME/CFS is three to four times more common in women than in men. Persons of all racial and ethnic backgrounds are affected; however, the illness is more prevalent in minority and socioeconomically disadvantaged groups. The highest prevalence of illness is in persons aged 40–50 years, but the age range is broad and includes children and adolescents.

ME/CFS patients, their families, and society all bear significant costs associated with this illness. These include direct medical costs for provider visits and medications and indirect costs of lost productivity. In the United States, the estimated annual cost of lost productivity ranges from 9–37 billion dollars, and for direct medical costs, ranges from 9–14 billion dollars, with nearly one quarter of direct medical expenses paid directly by patients and their families (*7–9*). When ME/CFS occurs in patients aged <25 years, these patients might not achieve their full educational potential, resulting in a life-long impact on their earnings (*7*).

ME/CFS patients have significant functional impairment as illustrated by findings from CDC's ongoing study of patients in seven clinics of ME/CFS specialists (Figure). Functioning of ME/CFS patients, as measured by subscale scores on the 36-Item Short Form Survey (SF-36), were well below those of healthy persons except for the two subscales reflecting mental and emotional functioning. Despite the severity of their illness, ME/CFS patients face significant barriers to receiving appropriate health care. A population-based study in Georgia found that 55% of persons with ME/CFS reported at least one barrier to health care; for example, 10% had financial barriers to seeking needed health care (*10*). Most persons with ME/CFS identified in population surveys have been ill >5 years and only approximately half continue to seek medical care (*4–6*). Further, only approximately 20% received a diagnosis, emphasizing the need for more physician education about this illness.

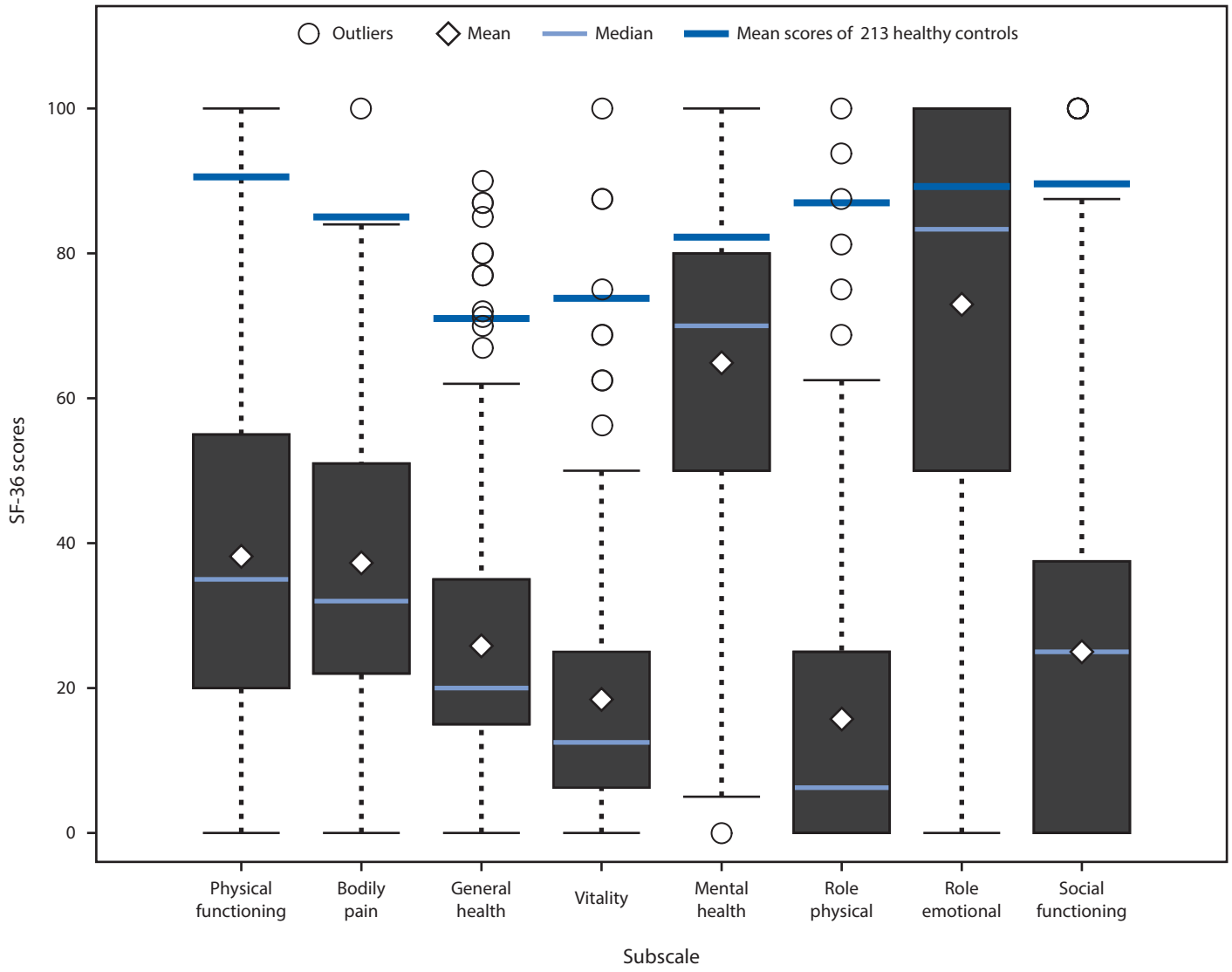
Clinical Approach to ME/CFS

There is no "typical" case, but a patient history can be useful in educating physicians about ME/CFS (Box 1). This composite case history illustrates the key features of ME/CFS: significant reduction in ability to perform usual activities accompanied by profound fatigue; significant worsening of symptoms after minimal physical or mental exertion (termed postexertional malaise); unrefreshing sleep; cognitive difficulties; and orthostatic intolerance (such as dizziness and lightheadedness upon standing up). In addition, this patient experienced widespread muscle pain, joint pain, and unpredictable waxing and waning of symptoms. Persons with ME/CFS might be misunderstood because they appear healthy and often have no abnormalities on routine laboratory testing. Clinicians need to be alert to this difficulty and take the time to elicit a good history of the illness, which is critical in the differential diagnosis and can provide evidence of ME/CFS.

Clinical evaluation includes a thorough medical history, psychosocial history, complete physical examination, mental health assessment, and basic laboratory tests to screen for

This is another in a series of occasional MMWR reports titled CDC Grand Rounds. These reports are based on grand rounds presentations at CDC on high-profile issues in public health science, practice, and policy. Information about CDC Grand Rounds is available at http://www.cdc.gov/cdcgrandrounds.

FIGURE. Functional status* of 471 patients enrolled in CDC's Multisite Clinical Assessment† of ME/CFS§ — United States, September 2015



Abbreviations: CFS = chronic fatigue syndrome; ME = myalgic encephalomyelitis; SF-36 = 36-Item Short Form Survey.

* Measured by box plots of scores in the eight subscales of SF-36 scores (25th and 75th percentile at bottom and top of box). SF-36 scores range from 0–100, with higher scores indicating better functioning.

† https://www.cdc.gov/cfs/programs/clinical-assessment/index.html.

§ ME/CFS patients show significant impairment, particularly in vitality and physical functioning subscale scores, but with preservation of mental health and emotional role functioning.

conditions that could cause symptoms similar to ME/CFS and that should be treated before attributing the illness to ME/CFS. The screening laboratory tests can include complete blood count with differential white blood cell count, sodium, potassium, glucose, blood urea nitrogen, creatinine, lactate dehydrogenase, aspartate transaminase, alanine transaminase, alkaline phosphatase, total protein, albumin, calcium, phosphorus, magnesium, thyroid stimulating hormone, free thyroxine, sedimentation rate, C-reactive protein, antinuclear antibodies, rheumatoid factor, and urinalysis (*11*). Patients might also have comorbid conditions such as fibromyalgia, irritable bowel and bladder, Sjögren's syndrome, chemical sensitivities, and allergies (*11*). Additional tests might be clinically indicated.

Cause or Causes of ME/CFS

The cause or causes of ME/CFS remain unknown. Patients often report an acute onset after a flu-like illness that does not go away, and some patients have a history of frequent infections before their illness. This suggests that an infection can trigger

the illness, though it is less clear that the ongoing chronic illness is perpetuated by an infection. Investigators have looked for, and failed to find, a single etiologic agent. However, chronic fatiguing illnesses have long been described in the medical literature following infection with several different agents. For example, a syndrome with similarities to ME/CFS occurs in approximately 10% of patients with a variety of viral and nonviral pathogens, such as Epstein-Barr Virus, Ross River Virus, *Coxiella burnetti* (Q fever), or *Giardia* (*12*). The severity of the acute infection was most predictive of subsequent illness, and there is no evidence of unusual persistence of infections in those who remain ill; baseline psychological profile and socioeconomic status did not predict who would become chronically ill (*12*). Other studies have found that, compared with healthy controls, persons with ME/CFS have had exposure to significantly more stressors (trauma and other adverse life events) and are more likely to have metabolic syndrome, as well as higher physiologic measures of neuroendocrine response to stress (allostatic load) (*13*). These associations are not specific to ME/CFS, because stress is a factor in many chronic illnesses. Twin and family studies support the contribution of both genetic and environmental factors in CFS (*14*). No single mutation or polymorphism has been found that explains most cases of the illness, and a polygenetic explanation for increased susceptibility is most likely.

Treatment of ME/CFS

At this time, there are no treatments (pharmacologic or nonpharmacologic) that have been proven effective in large randomized trials and replicated by other investigators in other groups of patients with ME/CFS. Recommendations are based on expert clinical opinion and the standard clinical approach to symptom management (*15*). Sleep disruption and pain are the symptoms usually addressed first, and consultation with sleep or pain management specialists might be helpful. Nonpharmacologic approaches might include Epsom salt soaks, massage, acupuncture, and, most importantly, activity management. Patients should be encouraged to stay active but not too active. They need to start with very low levels of activity and escalate the levels slowly. Brief intervals of activity should be followed by adequate rest to avoid triggering relapse or flare of symptoms, a manifestation of postexertional malaise. Finally, living with a chronic illness is extremely challenging, so attention should be given to addressing depression, anxiety, and improving coping skills.

Addressing ME/CFS

Recently, three important reports about ME/CFS have been published by authoritative agencies (*1*). The Institute of Medicine (IOM) issued a 300-page report in which a panel of physicians and scientists reviewed nearly 9,000 published articles (*3*). They concluded that ME/CFS is a biologically based illness and proposed a new case definition and name (systemic exertion intolerance). The National Institutes of Health (NIH) held a Pathways to Prevention workshop, drawing similar conclusions about the biology of ME/CFS, and the Agency for Healthcare Research and Quality prepared a review of published literature on diagnosis and treatment (*16*,*17*). The IOM panel concluded that "ME/CFS is a serious, chronic, complex systemic disease that often can profoundly affect the lives of patients." Both the IOM and NIH reports conclude that ME/CFS is not primarily a psychological illness, although it might lead to a reactive depression in some patients.

BOX 1. Myalgic encephalomyelitis/chronic fatigue syndrome case history

The patient, aged 37 years, was an internet technologist for a community bank. She had been physically active in sports and working out, and had been maintaining her own household when she experienced a flu-like illness in 2011. She was bedbound at first and slow to recover. Within days she noted an unusual fatigue after minimal activity, then insomnia, achiness in the joints, and generalized muscle pain and weakness. She soon found it difficult to recall recent conversations and events. Reading concentration was limited, and she had trouble comprehending what she had read or even television shows. She would search for words, lose her train of thought, and friends would sometimes have to finish sentences for her. Previously her sleep had always been good, but now she was restless at night and would awaken unrefreshed even after many hours of bed rest. She felt stiff, sore, and foggy for 1–2 hours after awakening. She noted dizziness or lightheadedness on getting up quickly, and on a couple of occasions "saw stars," but did not experience tunnel vision or fainting. The patient was unable to keep up the house, and she had to rely on friends and family to help her with cleaning, laundry, and shopping. She would attempt to keep up at home and at work, but exertion would inevitably make symptoms worse, and if she exerted too much she would end up sick and chairbound for 1–2 days afterward.

Evaluation by her primary care physician revealed low blood pressure, but there was no immediate orthostatic blood pressure drop and otherwise the examination was unremarkable. Blood work was unremarkable. Having no explanation for her symptoms despite the profound reduction in her physical abilities, the patient became anxious about her future and both frustrated and discouraged.

Although none of the biologic abnormalities identified in ME/CFS patients are sufficiently sensitive or specific to be used as a diagnostic test, the neurologic and immunologic abnormalities documented emphasize that patients' symptoms are real.

In the absence of a diagnostic test, the IOM report proposes use of a new clinical case definition (Box 2). The new case definition is shorter, easier to apply consistently, and emphasizes that ME/CFS is a diagnosis to be actively made, not simply a diagnosis of exclusion. The IOM report also recommended a new name be considered for the condition: systemic exertion intolerance disease.

It is clear that more basic science research is needed. In September 2015, the NIH intramural program began developing a research protocol to study ME/CFS. The overall hypothesis is that ME/CFS is attributable to an infection that results from immune-mediated brain dysfunction in some patients with acute onset illness. Aim 1 will define the clinical phenotype based on history and physical examination, neurologic assessment, neurocognitive testing, psychiatric evaluation, infectious disease, rheumatologic and neuroendocrine evaluations, and exercise testing. Aim 2 will define the physiologic basis of postexercise fatigue and malaise using functional magnetic resonance imaging, detailed metabolic studies, transcranial magnetic stimulation, and detailed autonomic testing before and after exercise challenge. Aim 3 will determine if there are abnormal immune parameters in the blood and spinal fluid and changes in microbiome profiles. Aim 4 will determine if features of the illness can be reproduced in ex vivo studies using cells or serum from patients and a variety of novel approaches such as induced pluripotent stem cell-derived neurons. Patients will be recruited primarily from well-studied cohorts under the care of clinicians with expertise in diagnosis and management of ME/CFS.

CDC is continuing its efforts to provide evidence-based information about ME/CFS to health care professionals. In 2012 and 2013, CDC partnered with Medscape to present two roundtable discussions that were targeted to primary care physicians. These reached more than 22,000 physicians and more than 6,000 CME credits were issued. CDC provided free online courses about ME/CFS accredited for both physicians, nurses, and other health care professionals. Because the topic of ME/CFS is rarely covered in medical school courses, CDC initiated a project to develop content for the MedEd Portal, a free online service of peer-reviewed content provided by the Association of American Medical Colleges to medical school faculty. To continue communication with the general public and advocacy community, CDC introduced patient-centered outreach and communication calls. These are 1-hour teleconferences held twice a year that are available toll-free in the United States. CDC uses the first 10 minutes to give an update on current activities of the ME/CFS program, and then an outside expert or group of experts presents information on a topic of interest to the community. These are followed by answers to questions submitted to the patient-centered outreach and communication email. Topics have included exercise, infection, and immunity in ME/CFS, ME/CFS and cognitive function, sleep research and ME/CFS, Stanford's research program, and self-management strategies in ME/CFS. Most recently, CDC has begun a new initiative to include broad stakeholder collaboration into developing educational materials. Including the viewpoints of patients, medical professional organizations, medical educators, expert clinicians, and government agencies will help assure the quality and usefulness of these products and facilitate broader dissemination in the medical community. With its demonstrated burden on individual patients and public health, ME/CFS should continue to be an area of active basic science and epidemiologic research, enhanced clinical diagnostic attention and training, and continued outreach, communication, and education.

BOX 2. Institute of Medicine criteria for diagnosis of myalgic encephalomyelitis/chronic fatigue syndrome

Patient has each of the following three symptoms at least half of the time, to at least a moderately severe degree:

- A substantial reduction or impairment in the ability to engage in preillness levels of occupational, educational, social, or personal activities that persists for >6 months and is accompanied by fatigue, which is often profound, is of new or definite onset (not lifelong), is not the result of ongoing excessive exertion, and is not substantially alleviated by rest.
- Postexertional malaise*
- Unrefreshing sleep*

Plus at least one of the two following manifestations (chronic, severe):

- Cognitive impairment*
- Orthostatic intolerance

Source: Institute of Medicine. Beyond myalgic encephalomyelitis/chronic fatigue syndrome: redefining an illness. Washington, D.C.: The National Academies Press; 2015. http://www.nationalacademies.org/hmd/reports/2015/me-cfs.aspx

* Frequency and severity of symptoms should be assessed. The diagnosis of myalgic encephalomyelitis/chronic fatigue syndrome should be questioned if patients do not have these symptoms at least half of the time with moderate, substantial, or severe intensity.

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Update: Influenza Activity — United States, October 2–December 17, 2016

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This report summarizes U.S. influenza activity* during October 2–December 17, 2016.† Influenza activity in the United States remained low in October and has been slowly increasing since November. Influenza A viruses were identified most frequently, with influenza A (H3N2) viruses predominating. Most influenza viruses characterized during this period were genetically or antigenically similar to the reference viruses representing vaccine components recommended for production in the 2016–17 Northern Hemisphere influenza vaccines.

Virologic Surveillance

U.S. World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System (NREVSS) laboratories include both clinical and public health laboratories throughout the United States that carry out virologic surveillance for influenza. During October 2–December 17, 2016, clinical laboratories in the United States tested 177,867 respiratory specimens for influenza viruses, 5,157 (2.9%) of which were positive (Figure 1); among identified viruses, 3,786 (73.4%) were influenza A and 1,371 (26.6%) were influenza B. Among influenza positive results reported by clinical laboratories, U.S. Department of Health and Human Services region 4§ (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) accounted for 2,210 (42.9 %) of all influenza positive results and 911 (66.4 %) of all influenza B viruses reported.

Public health laboratories in the United States tested 12,496 respiratory specimens collected during October 2–December 17, 2016. Among these, 2,103 were positive for influenza (Figure 2), including 1,930 (91.8%) that were positive for influenza A viruses and 173 (8.2%) that were positive for influenza B viruses. Among the 1,824 influenza A specimens subtyped, 95 (5.2%) were influenza A (H1N1)pdm09 and 1,729 (94.8%) were influenza A (H3N2). Among the 97 influenza B viruses for which lineage was determined, 39 (40.2%) belonged to the B/Yamagata lineage and 58 (59.8%) belonged to the B/Victoria lineage. Since October 2, 2016, influenza-positive tests have been reported from all U.S. Department of Health and Human Services regions.

Age was reported for 1,851 influenza-positive patients, among whom 140 (7.6%) were children aged 0–4 years, 608 (32.8%) were aged 5–24 years, 599 (32.4%) were aged 25–64 years, and 504 (27.2%) were aged ≥65 years. Influenza A (H3N2) viruses predominated in each age group, representing a range of 67.9% of influenza positives in persons aged 0–4 years to 86.5% in persons aged ≥65 years.

Novel Influenza A Viruses

One human infection with a novel influenza A virus was reported during October 2–December 17, 2016. The infection was reported by Iowa for the week ending November 19, 2016. The person was infected with an influenza A (H1N2) variant [(H1N2)v] virus¶ and was not hospitalized. Exposure to swine in the week preceding illness was reported, and there was no evidence of ongoing human-to-human transmission of the virus.

Antigenic and Genetic Characterization of Influenza Viruses

WHO collaborating laboratories in the United States are requested to submit a subset of influenza-positive respiratory specimens to CDC for further virus characterization. CDC characterizes influenza viruses through one or more laboratory tests, including genomic sequencing, antigenic characterization

* The CDC influenza surveillance system collects five categories of information from eight data sources: 1) viral surveillance (U.S. World Health Organization collaborating laboratories, the National Respiratory and Enteric Virus Surveillance System, and novel influenza A virus case reporting); 2) outpatient illness surveillance (U.S. Outpatient Influenza-Like Illness Surveillance Network); 3) mortality (the National Center for Health Statistics Mortality Surveillance System and influenza-associated pediatric mortality reports); 4) hospitalizations (FluSurv-NET, which includes the Emerging Infections Program and surveillance in three additional states); and 5) summary of the geographic spread of influenza (state and territorial epidemiologist reports). https://www.cdc.gov/flu/weekly/fluactivitysurv.htm.

† Data as of December 23, 2016.

§ The 10 regions include the following jurisdictions: *Region 1:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2*: New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands; *Region 3:* Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; Region 4: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5:* Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6:* Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7:* Iowa, Kansas, Missouri, and Nebraska; *Region 8:* Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9:* Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau; *Region 10:* Alaska, Idaho, Oregon, and Washington.

¶ Influenza viruses that circulate in swine are called swine influenza viruses when isolated from swine, but are called variant influenza viruses when isolated from humans. Seasonal influenza viruses that circulate worldwide in the human population have important antigenic and genetic differences from influenza viruses circulating in swine.

by hemagglutination inhibition (HI), and neutralization assays. Historically HI data have been used most commonly to assess the similarity between vaccine viruses and circulating viruses to infer how well the vaccine might work until such time as vaccine effectiveness estimates are available.** For all viruses characterized at CDC laboratories, next-generation sequencing is performed to determine the genetic identity of circulating viruses. For those viruses whose antigens cannot be characterized, their antigenic properties are inferred from viruses with matching genes whose antigen profile is known.

CDC has genetically characterized 293 viruses (31 influenza A (H1N1)pdm09; 215 influenza A (H3N2); and 47 influenza B viruses) collected since October 1, 2016. The hemagglutinin (HA) gene segment of all influenza A (H1N1)pdm09 viruses analyzed belonged to genetic group 6B.1. Influenza A (H3N2) virus HA gene segments analyzed belonged to genetic groups 3C.2a or 3C.3a. Genetic group 3C.2a includes a newly emerging subgroup known as 3C.2a1. The HA of influenza B/Victoria-lineage viruses all belonged to genetic group V1A. The HA of all influenza B/Yamagata-lineage viruses analyzed belonged to genetic group Y3.

Eighty-nine influenza viruses (26 influenza A (H1N1) pdm09; 42 influenza A (H3N2); and 21 influenza B viruses) collected since October 1, 2016 have been antigenically characterized. All 26 (100%) influenza A (H1N1)pdm09 viruses were antigenically similar to A/California/7/2009, the reference virus representing the influenza A (H1N1) component of the 2016–17 Northern Hemisphere vaccine. Thirty-nine of 42 (92.9%) influenza A (H3N2) viruses were antigenically similar to the A/Hong Kong/4801/2014–like cell propagated reference viruses belonging to genetic group 3C.2a and representing the influenza A (H3N2) component of the 2016–17 Northern Hemisphere vaccine. Six of seven (85.7%) influenza B/Victoria-lineage viruses were antigenically similar to B/Brisbane/60/2008, the reference virus representing the influenza B component of the 2016–17 Northern Hemisphere trivalent and quadrivalent vaccines. All 14 (100%) influenza B/Yamagata-lineage viruses were antigenically similar to B/Phuket/3073/2013, the reference virus representing the influenza B component of the 2016–17 Northern Hemisphere quadrivalent vaccine.

Antiviral Resistance of Influenza Viruses

The WHO Collaborating Center for Surveillance, Epidemiology, and Control of Influenza at CDC tested 205 influenza virus specimens (35 influenza A (H1N1)pdm09, 123 influenza A (H3N2), and 47 influenza B viruses) collected since October 1, 2016, in the United States for resistance to the influenza neuraminidase inhibitor antiviral medications oseltamivir, zanamivir, and peramivir, drugs currently approved for use against seasonal influenza. All 205 influenza viruses tested were found to be sensitive to all three antiviral medications. An additional 31 influenza A (H3N2) viruses were tested for resistance to oseltamivir and zanamivir, and they were found to be sensitive to both antiviral medications.

Outpatient Illness Surveillance

During October 2–December 17, 2016, the weekly percentage of outpatient visits for influenza-like illness (ILI)†† reported by approximately 2,000 U.S. Outpatient ILI Surveillance Network (ILINet) providers in 50 states, New York City, Chicago, the U.S. Virgin Islands, Puerto Rico, and the District of Columbia, ranged from 1.2% to 2.3%. The week ending December 17 was the first week of the 2016–17 season during which the percentage of outpatient visits for ILI was above the national baseline§§ (weekly percentage of visits for ILI was 2.3%, national baseline is 2.2%) (Figure 3). During the 1997–98 through 2015–16 influenza seasons, excluding the 2009 pandemic, the peak weekly percentages of outpatient visits for ILI ranged from 2.4% to 7.7%. For the week ending December 17, on a regional level, the percentage of outpatient visits for ILI ranged from 1.1% to 3.5%. Five regions (regions 2, 4, 8, 9, and 10) reported a proportion of outpatient visits for ILI at or above their region-specific baseline levels. Data collected from ILINet also are used to produce a measure of ILI activity¶¶ by jurisdiction. For the week ending December 17, Oklahoma and Puerto Rico experienced high ILI activity; New York City and two states (Arizona and Georgia) experienced moderate ILI activity; 10 states (Alabama, Colorado, Hawaii, Louisiana, Mississippi, Nevada, New Jersey, North Carolina, South Carolina, and Virginia) experienced low ILI activity. The remaining 37 states experienced

** A virus is considered "reference virus-like" if its hemagglutination inhibition (HI) or neutralization focus reduction (FRA) titer is within fourfold of the homologous HI/FRA titer of the reference strain. A virus is considered as low to the reference virus if there is an eightfold or greater reduction in the HI or FRA titer when compared with the homologous HI or FRA titer of the reference strain.

†† Defined as a fever (temperature ≥100°F [≥37.8°C]), oral or equivalent, and cough and/or sore throat, without a known cause other than influenza.

§§ The national and regional baselines are the mean percentage of visits for influenza-like illness (ILI) during noninfluenza weeks for the previous three seasons plus two standard deviations. Noninfluenza weeks are defined as periods of ≥2 consecutive weeks in which each week accounted for <2% of the season's total number of specimens that tested positive for influenza. National and regional percentages of patient visits for ILI are weighted on the basis of state population. Use of the national baseline for regional data is not appropriate.

¶¶ Activity levels are based on the percentage of outpatient visits in a jurisdiction attributed to ILI and are compared with the average percentage of ILI visits that occur during weeks with little or no influenza virus circulation. Activity levels range from minimal, corresponding to ILI activity from outpatient clinics at or below the average, to high, corresponding to ILI activity from outpatient clinics much higher than the average. Because the clinical definition of ILI is nonspecific, not all ILI is caused by influenza; however, when combined with laboratory data, the information on ILI activity provides a clearer picture of influenza activity in the United States.

minimal ILI activity, and the District of Columbia had insufficient data to calculate an ILI activity level.

Geographic Spread of Influenza Activity

Influenza activity levels reported by state and territorial epidemiologists indicate the geographic spread of influenza viruses. For the week ending December 17 (week 50), Puerto Rico reported widespread activity.*** Guam, the U.S. Virgin Islands, and 13 states (Alabama, Alaska, Connecticut, Massachusetts, New Hampshire, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, Virginia, and Washington) reported regional activity. The District of Columbia and 26 states (Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Hawaii, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, North Dakota, Ohio, Tennessee, Texas, Utah, and Wyoming) reported local activity, and 11 states (California, Illinois, Iowa, Kansas, Montana, New Mexico, Rhode Island, South Dakota, Vermont, West Virginia, and Wisconsin) reported sporadic activity.

Influenza-Associated Hospitalizations

CDC monitors hospitalizations associated with laboratory-confirmed influenza infection in adults and children through the Influenza Hospitalization Surveillance Network (FluSurv-NET),††† which covers approximately 27 million persons (9% of the U.S. population). During October 1–December 17, 2016, 676 laboratory-confirmed influenza-associated hospitalizations were reported, yielding an overall hospitalization rate of 2.4 per 100,000 population. Persons aged ≥65 years had the highest rate of laboratory-confirmed influenza-associated hospitalization and accounted for approximately 53.1% of reported influenza-associated hospitalizations.

Pneumonia and Influenza-Attributed Mortality

CDC tracks pneumonia and influenza (P&I)–attributed deaths through the National Center for Health Statistics (NCHS) Mortality Reporting System. The percentages of deaths attributed to P&I are released 2 weeks after the week of death to allow for collection of sufficient data to produce a stable P&I mortality percentage. Based on data from NCHS available December 23, 2016, 5.9% (1,763 of 29,760) of all U.S. deaths occurring during the week ending December 3, 2016 (week 48) were attributed to P&I. This percentage is below the epidemic threshold§§§ of 6.9% for week 48. Since October 2, the weekly percentage of deaths attributed to P&I has ranged from 5.4% to 5.9% and has not exceeded the epidemic threshold this season. P&I percentages for recent weeks might be artificially low because of a backlog of records requiring manual processing, and the percentage of deaths caused by P&I is higher among manually coded death certificates than among machine-coded death certificates. The percentages of death caused by P&I will likely increase as more data become available. During the previous five influenza seasons, the peak weekly percentage of deaths attributable to P&I ranged from 8.2% in the 2015–16 season to 11.1% in the 2012–13 season.

Influenza-Associated Pediatric Mortality

As of December 17, 2016 (week 50), no influenza-associated pediatric deaths occurring during the 2016–17 season were reported to CDC. During the previous three influenza seasons, the number of influenza-associated pediatric deaths ranged from 89 in the 2015–16 season to 148 in the 2014–15 season.

Discussion

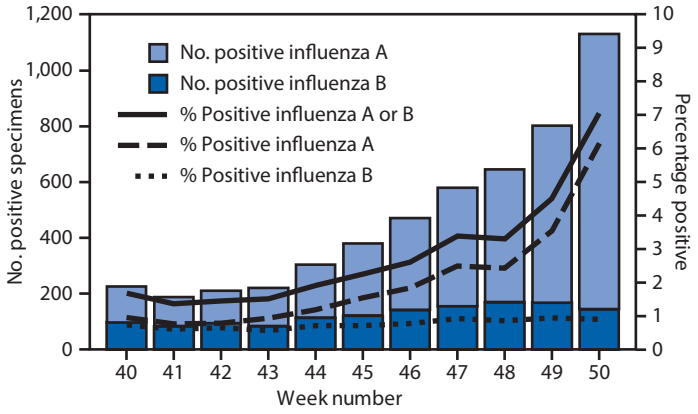
Influenza activity in the United States was low in October 2016, and has been slowly increasing since November, 2016. Peak influenza activity in the United States most commonly occurs during December–March, but substantial influenza activity can occur as early as November, and activity can last

*** Levels of activity are 1) no activity; 2) sporadic: isolated laboratory-confirmed influenza cases or a laboratory-confirmed outbreak in one institution, with no increase in activity; 3) local: increased ILI, or two or more institutional outbreaks (ILI or laboratory-confirmed influenza) in one region of the state, with recent laboratory evidence of influenza in that region; virus activity no greater than sporadic in other regions; 4) regional: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in two or more outbreaks, but less than half of the regions in the state with recent laboratory evidence of influenza in those regions; and 5) widespread: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least half the regions in the state, with recent laboratory evidence of influenza in the state.

††† FluSurv-NET conducts population-based surveillance for laboratory-confirmed, influenza-associated hospitalizations in children and adolescents aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). The FluSurv-NET covers approximately 70 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and additional Influenza Hospitalization Surveillance Project (IHSP) states. IHSP began during the 2009–10 season to enhance surveillance during the 2009 H1N1 pandemic. IHSP sites included Iowa, Idaho, Michigan, Oklahoma, and South Dakota during the 2009–10 season; Idaho, Michigan, Ohio, Oklahoma, Rhode Island, and Utah during the 2010–11 season; Michigan, Ohio, Rhode Island, and Utah during the 2011–12 season; Iowa, Michigan, Ohio, Rhode Island, and Utah during the 2012–13 season; and Michigan, Ohio, and Utah during the 2013–14, 2014–15, 2015–16, and 2016–17 seasons. Cumulative unadjusted incidence rates are calculated using CDC's National Center for Health Statistics population estimates for the counties included in the surveillance catchment area. Laboratory confirmation is dependent on clinician-ordered influenza testing, and testing for influenza often is underutilized because of the poor reliability of rapid test results and greater reliance on clinical diagnosis for influenza. Therefore, cases identified as part of influenza hospitalization surveillance likely are an underestimation of the actual number of persons hospitalized with influenza.

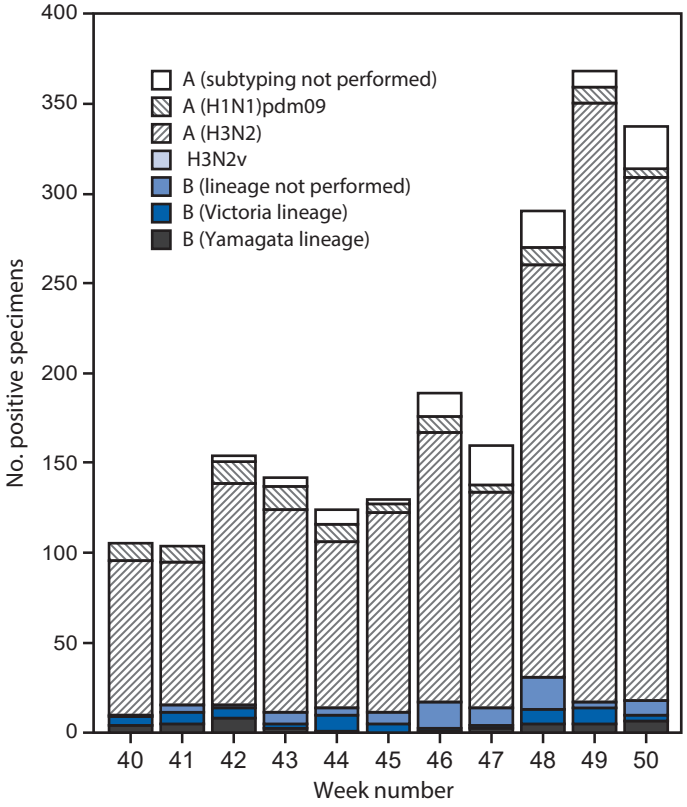
§§§ The seasonal baseline proportion of pneumonia and influenza (P&I) deaths is projected using a robust regression procedure, in which a periodic regression model is applied to the observed percentage of deaths from P&I that were reported by the National Center for Health Statistics Mortality Surveillance System during the preceding 5 years. The epidemic threshold is set at 1.645 standard deviations above the seasonal baseline.

FIGURE 1. Number* and percentage of respiratory specimens testing positive for influenza reported by clinical laboratories, by influenza virus type and surveillance week — United States, October 2–December 17, 2016†



* N = 5,157.
† As of December 23, 2016.

FIGURE 2. Number* of respiratory specimens testing positive for influenza reported by public health laboratories, by influenza virus type, subtype/lineage, and surveillance week — United States, October 2–December 17, 2016†



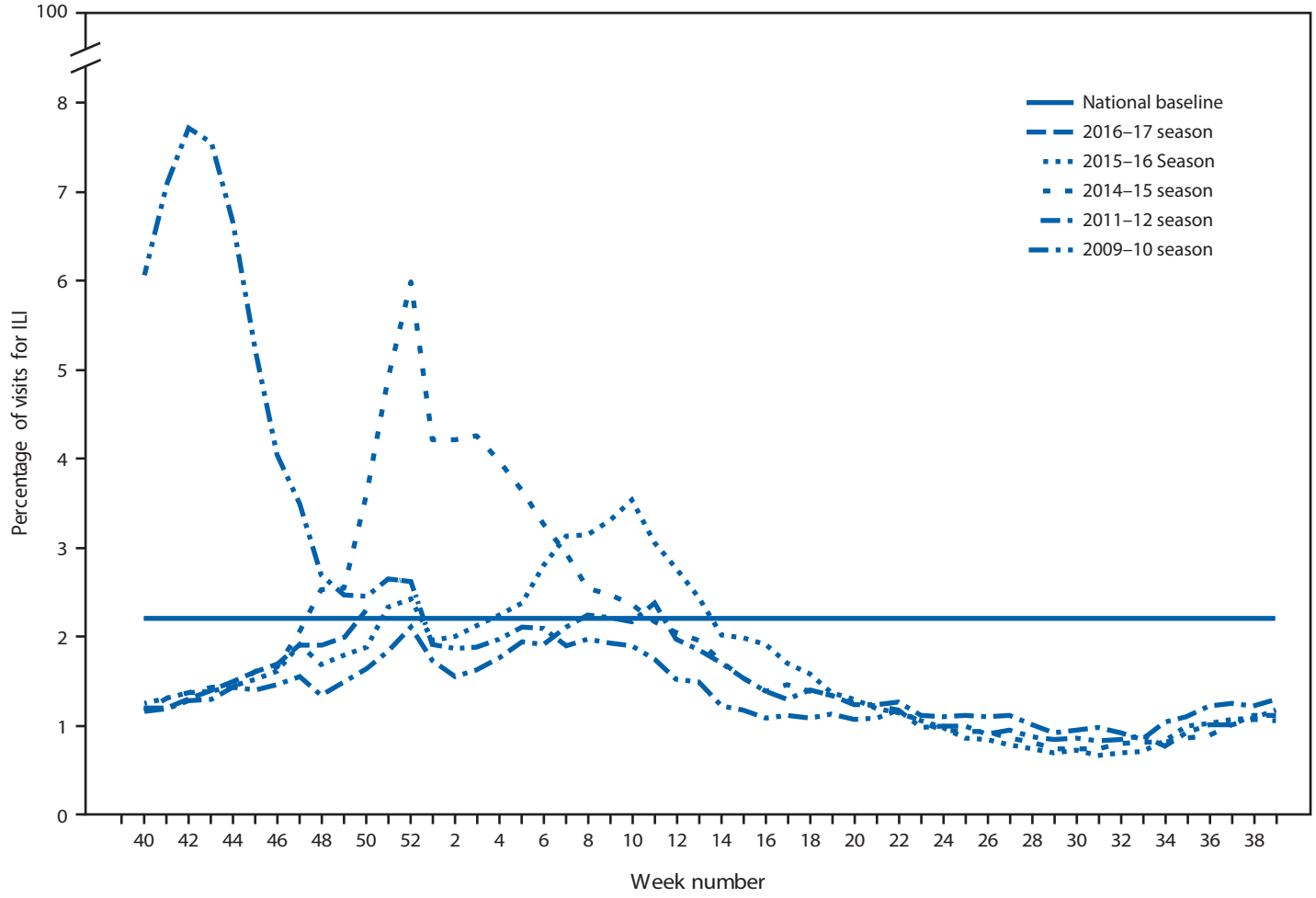
* N = 2,103.
† As of December 23, 2016.

until May. During the 2013–14 and 2014–15 influenza seasons, activity began relatively early and peaked in late December and early January; however, during the 2015–16 season, activity did not begin to increase until early January and peaked in mid-March. While it is not possible to predict when influenza activity will peak for the current season, influenza activity will likely increase in the coming weeks.

During October 2–December 17, 2016, influenza A (H3N2) viruses were identified more frequently in the United States than other influenza viruses, but influenza A (H1N1)pdm09 and influenza B viruses were also reported. Influenza A (H3N2) virus–predominant seasons are typically more severe overall than influenza A (H1N1)pdm09 virus–predominant seasons, and are especially severe among the elderly and the very young (*1*). The majority of the influenza viruses collected in the United States since October 1, 2016, were characterized antigenically or genetically as being similar to the reference viruses representing vaccine components recommended for the 2016–17 Northern Hemisphere influenza vaccines.

Annual influenza vaccination is the most effective method of preventing influenza and its complications. In the United States, during the 2010–11 through 2015–16 influenza seasons, influenza vaccination prevented an estimated 1.6 million to 6.7 million cases and 39,301–86,730 hospitalizations each season (*2*). Twice a year, WHO convenes a meeting to review available surveillance, laboratory, and clinical data and makes recommendations for the composition of influenza vaccines. These meetings take place in February and September for selection of vaccine strains for Northern Hemisphere and Southern Hemisphere influenza vaccines, respectively. In February 2016, WHO recommended that the 2016–17 trivalent influenza vaccines used in the Northern Hemisphere contain an A/California/7/2009 (H1N1)pdm09-like virus, an A/Hong Kong/4801/2014 (H3N2)-like virus, and a B/Brisbane/60/2008-like virus (B/Victoria lineage), and that quadrivalent vaccines contain the viruses recommended for the trivalent vaccines, as well as a B/Phuket/3073/2013-like virus (B/Yamagata lineage) (*3*). In September 2016, WHO recommended that the 2017 Southern Hemisphere influenza vaccine strains remain the same as the 2016–17 Northern Hemisphere influenza vaccine strains with the exception of the A (H1N1)pdm09-like virus. The A (H1N1) pdm09-like virus recommended for the 2017 Southern Hemisphere vaccine is an A/Michigan/45/2015 (H1N1) pdm09-like virus. This change represents the first update of the A(H1N1) vaccine strain since the 2009 pandemic. Although almost all recent A(H1N1)pdm09 viruses were antigenically indistinguishable from A/California/07/2009 using ferret antisera, some human postvaccination sera

FIGURE 3. Percentage of visits for influenza-like illness (ILI)* reported to CDC, by surveillance week — Outpatient Influenza-Like Illness Surveillance Network, United States, 2016–17 influenza season and selected previous influenza seasons



* Defined as fever (temperature ≥100°F [≥37.8°C]), oral or equivalent, and cough and/or sore throat, without a known cause other than influenza.

showed reduced titers against recently circulating A (H1N1) pdm09 viruses belonging to the 6B.1 and 6B.2 genetic groups (*3*,*4*).

As of early November, 2016, approximately 60% of the U.S. population had not been vaccinated against influenza for the 2016–17 season (*5*).Overall influenza vaccination coverage during the 2015–16 season was 45.6%. This represents a 1.5 percentage point decrease compared with the 2014–15 season, a decline driven by decreased vaccine uptake among persons aged 50–64 years and ≥65 years (*6*). Because the peak month for influenza activity typically ranges from December to March, and influenza activity for the current season is just beginning to increase, receiving influenza vaccine at this time still offers substantial public health benefits. Health care providers should recommend influenza vaccine now and throughout the influenza season to all unvaccinated persons aged ≥6 months who do not have contraindications. Children aged 6 months–8 years who have not previously received a total of ≥2 doses of any trivalent or quadrivalent influenza vaccine (doses do not have to be received in the same influenza season) before July 1, 2016, require 2 doses for the 2016–17 season. The interval between the 2 doses should be at least 4 weeks (*7*).

Although influenza vaccination is the best way to reduce the impact of influenza, antiviral medications continue to be an important adjunct to vaccination for reducing the health impact of influenza. Available effective antiviral medications include oseltamivir, zanamivir, and peramivir. All influenza viruses collected since October 1, and tested for antiviral resistance, were found to be susceptible to these antiviral medications. Treatment as soon as possible with influenza antivirals is recommended for patients with confirmed or suspected influenza who have severe, complicated, or progressive illness; who require hospitalization; or who are at high risk

Summary

What is already known about this topic?

CDC collects, compiles, and analyzes data on influenza activity year-round in the United States. The influenza season generally begins in the fall and continues through the winter and spring months; however, the timing and severity of circulating influenza viruses can vary by geographic location and season.

What is added by this report?

During October 2–December 17, 2016, influenza activity remained low in October but has been slowly increasing since November in the United States. Influenza A (H3N2) viruses were the most frequently identified viruses. Almost all viruses characterized thus far this season have been similar to the components of the 2016–17 Northern Hemisphere trivalent and quadrivalent influenza vaccine formulations. All influenza viruses tested to date have been sensitive to the antiviral drugs oseltamivir, zanamivir, and peramivir.

What are the implications for public health practice?

Vaccination is the primary method to prevent influenza illness and its complications. Health care providers should continue to recommend influenza vaccination to all unvaccinated persons aged ≥6 months now and throughout the influenza season. As an adjunct to vaccine, treatment with influenza antiviral medications is recommended for patients with confirmed or suspected influenza who have severe, complicated, or progressive illness; who require hospitalization; or who are at high risk for influenza-related complications. Antivirals can lessen severity and duration of illness and can reduce severe outcomes of influenza. Antiviral medications work best when administered early in the course of influenza illness.

for influenza complications.¶¶¶ Providers should not delay treatment while waiting for test results and should not rely on insensitive assays such as rapid antigen-detection influenza diagnostic tests to determine treatment (*8*).

Influenza surveillance reports for the United States are posted online weekly (https://www.cdc.gov/flu/weekly). Additional information regarding influenza viruses, influenza surveillance, influenza vaccine, influenza antiviral medications, and novel influenza A infections in humans is online (https://www.cdc.gov/flu).

¶¶¶ Persons at higher risk include 1) children aged <2 years; 2) adults aged ≥65 years; 3) persons with chronic pulmonary conditions (including asthma), cardiovascular disease (except hypertension alone), renal, hepatic, hematologic (including sickle cell) disease, metabolic disorders (including diabetes mellitus), or neurologic and neurodevelopmental conditions (including disorders of the brain, spinal cord, peripheral nerves, and muscles, such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury); 4) persons with immunosuppression, including that caused by medications or by human immunodeficiency virus infection; 5) women who are pregnant or postpartum (within 2 weeks after delivery); 6) persons aged ≤18 years who are receiving long-term aspirin therapy; 7) American Indians/Alaska Natives; 8) persons with extreme obesity (i.e., body mass index ≥40); and 9) residents of nursing homes and other chronic care facilities.

Acknowledgments

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Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015

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On December 16, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

The U.S. opioid epidemic is continuing, and drug overdose deaths nearly tripled during 1999–2014. Among 47,055 drug overdose deaths that occurred in 2014 in the United States, 28,647 (60.9%) involved an opioid (*1*). Illicit opioids are contributing to the increase in opioid overdose deaths (*2*,*3*). In an effort to target prevention strategies to address the rapidly changing epidemic, CDC examined overall drug overdose death rates during 2010–2015 and opioid overdose death rates during 2014–2015 by subcategories (natural/semisynthetic opioids, methadone, heroin, and synthetic opioids other than methadone).* Rates were stratified by demographics, region, and by 28 states with high quality reporting on death certificates of specific drugs involved in overdose deaths. During 2015, drug overdoses accounted for 52,404 U.S. deaths, including 33,091 (63.1%) that involved an opioid. There has been progress in preventing methadone deaths, and death rates declined by 9.1%. However, rates of deaths involving other opioids, specifically heroin and synthetic opioids other than methadone (likely driven primarily by illicitly manufactured fentanyl) (*2*,*3*), increased sharply overall and across many states. A multifaceted, collaborative public health and law enforcement approach is urgently needed. Response efforts include implementing the CDC *Guideline for Prescribing Opioids for Chronic Pain* (*4*), improving access to and use of prescription drug monitoring programs, enhancing naloxone distribution and other harm reduction approaches, increasing opioid use disorder treatment capacity, improving linkage into treatment, and supporting law enforcement strategies to reduce the illicit opioid supply.

The National Vital Statistics System multiple cause-of-death mortality files were used to record drug overdose deaths.† Drug overdose deaths were identified using the *International Classification of Disease, Tenth Revision* (ICD-10), based on the ICD-10 underlying cause-of-death codes X40–44 (unintentional), X60–64 (suicide), X85 (homicide), or Y10–Y14 (undetermined intent). Among deaths with drug overdose as the underlying cause, the type of opioid is indicated by the following ICD-10 multiple cause-of-death codes: opioids (T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6); natural/semisynthetic opioids (T40.2); methadone (T40.3); synthetic opioids other than methadone (T40.4); and heroin (T40.1). Some deaths involved more than one type of opioid; these deaths were included in the rates for each subcategory. Therefore, categories of deaths presented are not mutually exclusive.§

Changes in drug overdose death rates were analyzed for all 50 states and the District of Columbia (DC) from 2010 to 2015 using joinpoint regression.¶ Opioid overdose death rates were examined for the period 2014–2015 by subcategories (natural/semisynthetic opioids, methadone, heroin, and synthetic opioids other than methadone) and by demographics, region, and across states. State-level analyses were conducted for 28 states meeting the following criteria: 1) >80% of drug overdose death certificates named at least one specific drug in 2014; 2) change from 2014 to 2015 in the percentage of death certificates reporting at least one specific drug was <10 percentage points**; and 3) ≥20 deaths occurred during 2014 and 2015 in at least two opioid subcategories examined. Analyses comparing changes in age-adjusted death rates from 2014 to 2015 used z-tests when deaths were ≥100 and nonoverlapping confidence intervals based on a gamma distribution when deaths were <100.††

The drug overdose death rate increased significantly from 12.3 per 100,000 population in 2010 to 16.3 in 2015. Death rates increased in 30 states and DC and remained stable in 19 states (Figure). Two states had changing trends during this period of decreasing rates followed by increases.§§ During 2015, a total of 52,404 persons in the United States died from

* Natural opioids include morphine and codeine, and semisynthetic opioids include drugs such as oxycodone, hydrocodone, hydromorphone, and oxymorphone. Methadone is a synthetic opioid. Synthetic opioids, other than methadone, include drugs such as tramadol and fentanyl. Heroin is an illicit opioid synthesized from morphine that can be a white or brown powder, or a black sticky substance.

† https://www.cdc.gov/nchs/nvss/mortality_public_use_data.htm.

§ For example, a death involving both a synthetic opioid other than methadone and heroin would be included in both the "synthetic other than methadone" and heroin death rates.

¶ For all analyses, a p-value of <0.05 was considered to be statistically significant. https://surveillance.cancer.gov/joinpoint/.

** States whose reporting of any specific drug or drugs involved in an overdose changed by ≥10 percentage points from 2014 to 2015 were excluded, because drug-specific overdose numbers and rates might change substantially from 2014 to 2015 because of changes in reporting.

†† Age-adjusted death rates were calculated by applying age-specific death rates to the 2000 U.S. Census standard population age distribution https://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf. For z-tests, a p-value of <0.05 was considered to be statistically significant.

§§ Florida and South Carolina, had both decreasing and increasing trends during this period. In Florida, rates decreased from 2010 to 2013, then increased to 2015; in South Carolina, rates decreased from 2010 to 2012, then increased to 2015.

Summary

What is already known about this topic?

The U.S. opioid epidemic is continuing. Drug overdose deaths nearly tripled during 1999–2014. In 2014, among 47,055 drug overdose deaths, 61% involved an opioid. During 2013–2014, deaths associated with the most commonly prescribed opioids (natural/semisynthetic opioids) continued to increase slightly; however, the rapid increase in deaths appears to be driven by heroin and synthetic opioids other than methadone.

What is added by this report?

From 2014 to 2015, the death rate from synthetic opioids other than methadone, which includes fentanyl, increased by 72.2%, and heroin death rates increased by 20.6%. Rates of death involving heroin and synthetic opioids other than methadone increased across all demographic groups, regions, and in numerous states. Natural/semisynthetic opioid death rates increased by 2.6%, whereas, methadone death rates decreased by 9.1%.

What are the implications for public health practice?

There is an urgent need for a multifaceted, collaborative public health and law enforcement approach to the opioid epidemic, including implementing the CDC *Guideline for Prescribing Opioids for Chronic Pain*; improving access to and use of prescription drug monitoring programs; expanding naloxone distribution; enhancing opioid use disorder treatment capacity and linkage into treatment, including medication-assisted treatment; implementing harm reduction approaches, such as syringe services program; and supporting law enforcement strategies to reduce the illicit opioid supply.

a drug overdose, an increase from 47,055 in 2014; among these deaths, 33,091 (63.1%) involved an opioid, an increase from 28,647 in 2014. The age-adjusted opioid-involved death rate increased by 15.6%, from 9.0 per 100,000 in 2014 to 10.4 in 2015, driven largely by increases in deaths involving heroin and synthetic opioids other than methadone. Death rates for natural/semisynthetic opioids, heroin, and synthetic opioids other than methadone increased by 2.6%, 20.6%, and 72.2%, respectively (Table 1) (Table 2). Methadone death rates decreased by 9.1% (Table 1).

During 2014–2015, rates of natural/semisynthetic opioid deaths increased among males overall, both sexes aged 25–44 years, and non-Hispanic whites. Methadone death rates decreased among males and females overall, but increased among persons aged ≥65 years (Table 1). Death rates involving heroin and synthetic opioids other than methadone increased in both males and females, persons aged ≥15 years, and all racial/ethnic populations; however, heroin death rates among males aged 15–24 years remained stable. In 2015, death rates involving synthetic opioids other than methadone were highest among males aged 25–44 years (8.9 per 100,000), increasing 102.3% from 2014 to 2015 (Table 2). Heroin death rates also were highest in this demographic group (13.2), increasing 22.2% from 2014 to 2015. Natural/semisynthetic opioid death rates increased in the Northeast and South U.S. Census regions, and methadone death rates decreased in the South (Table 1). Death rates involving synthetic opioids other than methadone and heroin increased in all regions from 2014 to 2015 (Table 2).

Among the 28 states meeting inclusion criteria for state-level analyses, 16 (57.1%) experienced increases in death rates involving synthetic opioids other than methadone, and 11 (39.3%) experienced increases in heroin death rates from 2014 to 2015. The largest absolute rate change in deaths from synthetic opioids other than methadone occurred in Massachusetts, New Hampshire, Ohio, Rhode Island and West Virginia. The largest percentage increases in rates occurred in New York (135.7%), Connecticut (125.9%) and Illinois (120%) (Table 2). Connecticut, Massachusetts, Ohio, and West Virginia experienced the largest absolute rate changes in heroin deaths, while the largest percentage increases in rates occurred in South Carolina (57.1%), North Carolina (46.4%), and Tennessee (43.5) (Table 2). Three states (New Mexico, Oklahoma, and Virginia) experienced decreases in natural/semi-synthetic opioid death rates, while increases occurred in five states (Massachusetts, New York, North Carolina, Ohio, and Tennessee) (Table 1).

Discussion

During 2010–2015, the rate of drug overdose deaths in the United States increased in 30 states and DC, remained stable in 19 states, and showed decreasing trends followed by increases in two states.[§§,¶¶] From 2014 to 2015, drug overdose deaths increased by 5,349 (11.4%), signifying a continuing trend observed since 1999 (*1*). Opioid death rates increased by 15.6% from 2014 to 2015. These significant increases in death rates were driven by synthetic opioids other than methadone (72.2%), most likely illicitly-manufactured fentanyl (*2*,*3*), and heroin (20.6%). Increases in these opioid subcategories occurred overall and across all demographics and regions. Natural/semisynthetic opioid death rates increased by 2.6%, whereas methadone death rates decreased by 9.1%.

These findings are consistent with recent reports highlighting the increasing trend in deaths involving heroin and synthetic opioids other than methadone (*1*–*3*,*5*). The number of deaths involving synthetic opioids other than methadone have been associated with the number of drug products obtained by law enforcement testing positive for fentanyl, but not with fentanyl prescribing rates (*2*,*3*). A recent report found that these increases, likely attributable to illicitly manufactured fentanyl, were concentrated in eight of 27 states examined (*2*).

¶¶ https://www.cdc.gov/drugoverdose/data/statedeaths.html.

FIGURE. Age-adjusted rate* of drug overdose deaths,† by state — 2010 and 2015§

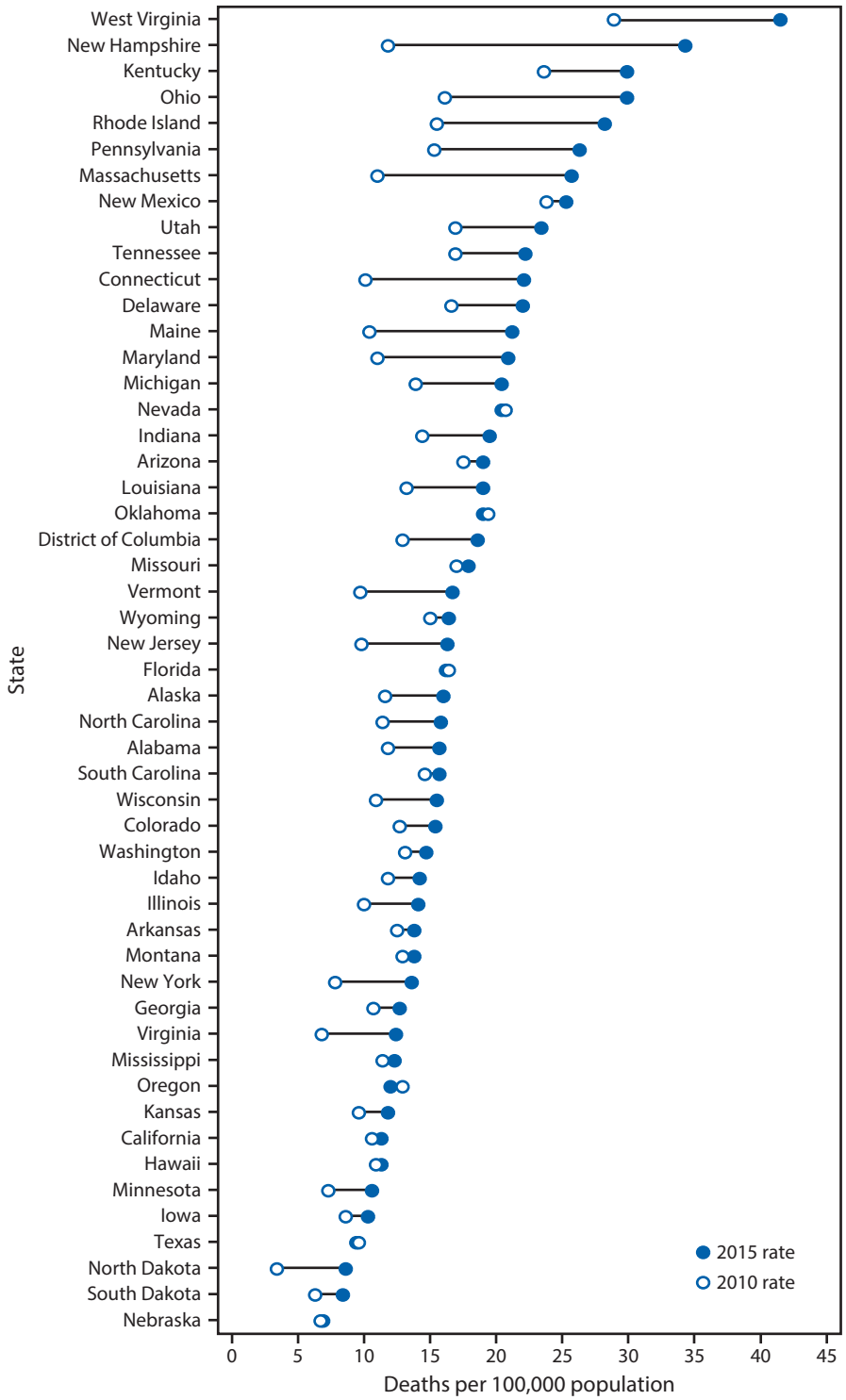

TABLE 1. Number and age-adjusted rate of drug overdose deaths* involving natural and semisynthetic opioids† and methadone,§,¶ by sex, age group, race/ethnicity, U.S. Census region, and selected states†† — United States, 2014 and 2015**

	Natural and semisynthetic opioids			Methadone		
	2014	2015	% change in rate, 2014 to 2015	2014	2015	% change in rate, 2014 to 2015
Characteristic	No. (Rate)	No. (Rate)		No. (Rate)	No. (Rate)	
Overall	**12,159 (3.8)**	**12,727 (3.9)**	**2.6§§**	**3,400 (1.1)**	**3,301 (1.0)**	**-9.1§§**
Sex						
Male	6,732 (4.2)	7,117 (4.4)	4.8§§	2,009 (1.3)	1,939 (1.2)	-7.7§§
Female	5,427 (3.3)	5,610 (3.4)	3.0	1,391 (0.9)	1,362 (0.8)	-11.1§§
Age group (yrs)						
0–14	42 (0.1)	48 (0.1)	0.0	14 –¶¶	13 –¶¶	–¶¶
15–24	726 (1.7)	715 (1.6)	-5.9	241 (0.5)	201 (0.5)	0.0
25–34	2,115 (4.9)	2,327 (5.3)	8.2§§	796 (1.8)	735 (1.7)	-5.6
35–44	2,644 (6.5)	2,819 (6.9)	6.2§§	768 (1.9)	739 (1.8)	-5.3
45–54	3,488 (8.0)	3,479 (8.1)	1.3	854 (2.0)	843 (2.0)	0.0
55–64	2,437 (6.1)	2,602 (6.4)	4.9	629 (1.6)	642 (1.6)	0.0
≥65	706 (1.5)	736 (1.5)	0.0	98 (0.2)	127 (0.3)	50.0§§
Sex/Age group (yrs)						
Male						
15–24	529 (2.3)	493 (2.2)	-4.3	173 (0.8)	149 (0.7)	-12.5
25–44	2,869 (6.8)	3,139 (7.4)	8.8§§	969 (2.3)	926 (2.2)	-4.3
45–64	3,015 (7.4)	3,095 (7.5)	1.4	808 (2.0)	777 (1.9)	-5.0
Female						
15–24	197 (0.9)	222 (1.0)	11.1	68 (0.3)	52 (0.2)	-33.3
25–44	1,890 (4.5)	2,007 (4.8)	6.7§§	595 (1.4)	548 (1.3)	-7.1
45–64	2,910 (6.8)	2,986 (6.9)	1.5	675 (1.6)	708 (1.6)	0.0
Race/Ethnicity**						
White, non-Hispanic	10,308 (5.0)	10,774 (5.3)	6.0§§	2,845 (1.4)	2,725 (1.4)	0.0
Black, non-Hispanic	814 (2.0)	878 (2.1)	5.0	256 (0.6)	247 (0.6)	0.0
Hispanic	727 (1.4)	780 (1.5)	7.1	228 (0.5)	235 (0.5)	0.0
U.S. Census region of residence						
Northeast	1,851 (3.3)	2,095 (3.6)	9.1§§	587 (1.0)	643 (1.1)	10.0
Midwest	2,205 (3.3)	2,302 (3.4)	3.0	675 (1.0)	673 (1.0)	0.0
South	5,101 (4.2)	5,374 (4.4)	4.8§§	1,298 (1.1)	1,228 (1.0)	-9.1§§
West	3,002 (3.9)	2,956 (3.8)	-2.6	840 (1.1)	757 (1.0)	-9.1

See table footnotes on next page.

The decline in methadone death rates, a trend observed since 2008, followed efforts to reduce methadone use for pain, including Food and Drug Administration warnings, limits on high dose formulations, and clinical guidelines (*6*). The small increase in natural/semisynthetic opioid death rates illustrates an ongoing problem with prescription opioids; however, the increase has slowed from 2013–2014, potentially because of policy and health system changes, required prescription drug monitoring program review, legislative changes in naloxone distribution, and prescribing guidelines (*7*,*8*).***

The findings in this report are subject to at least five limitations. First, factors related to death investigation might affect rate estimates involving specific drugs. At autopsy, the substances tested for, and circumstances under which tests are performed to determine which drugs are present, might vary by jurisdiction and over time. Second, the percentage of deaths with specific drugs identified on the death certificate varies by jurisdiction and over time. Nationally, 19% (in 2014) and 17% (in 2015) of drug overdose death certificates did not include the specific types of drugs involved. Additionally, the percentage of drug overdose deaths with specific drugs identified on the death certificate varies widely by state, ranging from 47.4% to 99%. Variations in reporting across states prevent comparison of rates between states. Third, improvements in testing and reporting of specific drugs might have contributed to some observed increases in opioid-involved death rates. Fourth, because heroin and morphine are metabolized similarly (*9*), some heroin deaths might have been misclassified as morphine deaths, resulting in underreporting of heroin deaths. Finally,

*** Some state examples are available. New Mexico: https://nmhealth.org/news/information/2016/6/?view=429; https://nmhealth.org/news/information/2016/9/?view=484; and http://hscnews.unm.edu/news/education-program-successful-in-reducing-opioid-abuse010715; Oklahoma: https://www.ok.gov/health2/documents/UP_Oklahoma_Office_Based_Guidelines.pdf; Oregon: http://www.orpdmp.com. Washington: https://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2014.302367?journalCode=ajph.

TABLE 1. (*Continued*) Number and age-adjusted rate of drug overdose deaths* involving natural and semisynthetic opioids† and methadone,§,¶ by sex, age group, race/ethnicity, U.S. Census region, and selected states†† — United States, 2014 and 2015**

	Natural and semisynthetic opioids			Methadone		
	2014	2015	% change in rate,	2014	2015	% change in rate,
Characteristic	No. (Rate)	No. (Rate)	2014 to 2015	No. (Rate)	No. (Rate)	2014 to 2015
Selected states††						
States with very good or excellent reporting (n = 21)						
Alaska	40 (5.6)	51 (6.5)	16.1	12 –¶¶	10 –¶¶	–¶¶
Connecticut	157 (4.3)	183 (4.8)	11.6	50 (1.4)	72 (1.9)	35.7
Iowa	81 (2.7)	75 (2.5)	-7.4	16 –¶¶	24 (0.8)	–¶¶
Maine	80 (6.1)	102 (7.7)	26.2	29 (2.2)	36 (2.8)	27.3
Maryland	388 (6.2)	398 (6.5)	4.8	153 (2.4)	182 (2.9)	20.8
Massachusetts	178 (2.6)	225 (3.3)	26.9§§	88 (1.3)	82 (1.2)	-7.7
Nevada	224 (7.4)	259 (8.6)	16.2	64 (2.2)	57 (1.9)	-13.6
New Hampshire	81 (5.8)	63 (4.4)	-24.1	29 (2.3)	25 (1.9)	-17.4
New Mexico	223 (10.9)	160 (8.1)	-25.7§§	45 (2.3)	33 (1.6)	-30.4
New York	608 (3.0)	705 (3.4)	13.3§§	231 (1.1)	246 (1.2)	9.1
North Carolina	462 (4.7)	554 (5.5)	17.0§§	131 (1.4)	108 (1.1)	-21.4
Oklahoma	370 (9.6)	277 (7.2)	-25.0§§	67 (1.7)	62 (1.7)	0.0
Oregon	137 (3.2)	150 (3.6)	12.5	59 (1.4)	70 (1.7)	21.4
Rhode Island	70 (6.7)	95 (8.3)	23.9	24 (2.2)	30 (2.4)	9.1
South Carolina	319 (6.5)	322 (6.5)	0.0	77 (1.6)	57 (1.2)	-25.0
Utah	367 (13.6)	357 (12.7)	-6.6	47 (1.7)	45 (1.6)	-5.9
Vermont	21 (3.4)	25 (3.9)	14.7	–¶¶ –¶¶	–¶¶ –¶¶	–¶¶
Virginia	323 (3.9)	276 (3.3)	-15.4§§	105 (1.2)	67 (0.8)	-33.3§§
Washington	288 (3.8)	261 (3.5)	-7.9	115 (1.5)	111 (1.4)	-6.7
West Virginia	363 (20.2)	356 (19.8)	-2.0	35 (2.0)	29 (1.7)	-15.0
Wisconsin	279 (4.8)	249 (4.3)	-10.4	78 (1.4)	73 (1.3)	-7.1
States with good reporting (n = 7)						
Colorado	259 (4.6)	259 (4.5)	-2.2	51 (0.9)	34 (0.6)	-33.3
Georgia	388 (3.8)	435 (4.2)	10.5	124 (1.2)	115 (1.1)	-8.3
Illinois	253 (1.9)	271 (2.0)	5.3	106 (0.9)	99 (0.8)	-11.1
Minnesota	102 (1.9)	125 (2.2)	15.8	81 (1.6)	55 (1.0)	-37.5
Missouri	237 (4.0)	237 (3.9)	-2.5	53 (0.9)	62 (1.0)	11.1
Ohio	618 (5.4)	690 (6.1)	13.0§§	107 (0.9)	109 (1.0)	11.1
Tennessee	554 (8.6)	643 (9.7)	12.8§§	71 (1.1)	67 (1.0)	-9.1

Source: CDC. National Vital Statistics System, Mortality. CDC WONDER. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://wonder.cdc.gov/.

* Rates are for the number of deaths per 100,000 population. Age-adjusted death rates were calculated using the direct method and the 2000 standard population. Deaths were classified using the *International Classification of Diseases, Tenth Revision* (ICD–10). Drug overdose deaths were identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14.

† Drug overdose deaths, as defined, that have natural and semisynthetic opioids (T40.2) as contributing causes.

§ Drug overdose deaths, as defined, that have methadone (T40.3) as a contributing cause.

¶ Categories of deaths are not exclusive because deaths might involve more than one drug. Summing categories will result in a number greater than the total number of deaths in a year.

** Data for Hispanic ethnicity should be interpreted with caution; studies comparing Hispanic ethnicity on death certificates and on census surveys have shown inconsistent reporting.

†† Analyses were limited to states meeting the following criteria. For states with very good to excellent reporting, ≥90% of drug overdose death certificates mention at least one specific drug in 2014, with the change in percentage of drug overdose deaths mentioning at least one specific drug differing by <10 percentage points from 2014 to 2015. States with good reporting had 80% to <90% of drug overdose death certificates mention at least one specific drug in 2014, with the change in the percentage of drug overdose deaths mentioning at least one specific drug differing by <10 percentage points from 2014 to 2015. Rate comparisons between states should not be made because of variations in reporting across states.

§§ Statistically significant at p<0.05 level. Gamma tests were used if the number of deaths was <100 in 2014 or 2015, and z-tests were used if the number of deaths was ≥100 in both 2014 and 2015.

¶¶ Cells with nine or fewer deaths are not reported, and rates based on <20 deaths are not considered reliable and not reported.

TABLE 2. Number and age-adjusted rate of drug overdose deaths* involving synthetic opioids other than methadone† and heroin,§,¶ by sex, age group, race/ethnicity, U.S. Census region, and selected states†† — United States, 2014 and 2015**

	Synthetic opioids other than methadone			Heroin		
	2014	2015	% change in rate, 2014 to 2015	2014	2015	% change in rate, 2014 to 2015
Characteristic	No. (Rate)	No. (Rate)		No. (Rate)	No. (Rate)	
Overall	**5,544 (1.8)**	**9,580 (3.1)**	**72.2§§**	**10,574 (3.4)**	**12,989 (4.1)**	**20.6§§**
Sex						
Male	3,465 (2.2)	6,560 (4.2)	90.9§§	8,160 (5.2)	9,881 (6.3)	21.2§§
Female	2,079 (1.3)	3,020 (1.9)	46.2§§	2,414 (1.6)	3,108 (2.0)	25.0§§
Age group (yrs)						
0–14	10 –¶¶	14 –¶¶	–¶¶	–¶¶ –¶¶	–¶¶ –¶¶	–¶¶
15–24	514 (1.2)	999 (2.3)	91.7§§	1452 (3.3)	1,649 (3.8)	15.2§§
25–34	1474 (3.4)	2,896 (6.6)	94.1§§	3493 (8.0)	4,292 (9.7)	21.3§§
35–44	1264 (3.1)	2,289 (5.6)	80.6§§	2398 (5.9)	3,012 (7.4)	25.4§§
45–54	1359 (3.1)	1,982 (4.6)	48.4§§	2030 (4.7)	2,439 (5.6)	19.1§§
55–64	742 (1.9)	1,167 (2.9)	52.6§§	1064 (2.7)	1,407 (3.4)	25.9§§
≥65	181 (0.4)	232 (0.5)	25.0§§	136 (0.3)	184 (0.4)	33.3§§
Sex/Age group (yrs)						
Male						
15–24	376 (1.7)	718 (3.2)	88.2§§	1,079 (4.8)	1,172 (5.2)	8.3
25–44	1,845 (4.4)	3,764 (8.9)	102.3§§	4,566 (10.8)	5,602 (13.2)	22.2§§
45–64	1,176 (2.9)	1,948 (4.7)	65.5§§	2,397 (5.9)	2,953 (7.2)	22.0§§
Female						
15–24	138 (0.6)	281 (1.3)	116.7§§	373 (1.7)	477 (2.2)	29.4§§
25–44	893 (2.1)	1,421 (3.4)	61.9§§	1,325 (3.2)	1,702 (4.0)	25.0§§
45–64	925 (2.2)	1,201 (2.8)	27.3§§	697 (1.6)	893 (2.1)	31.3§§
Race/Ethnicity**						
White, non-Hispanic	4,685 (2.4)	7,995 (4.2)	75.0§§	8,253 (4.4)	10,050 (5.4)	22.7§§
Black, non-Hispanic	449 (1.1)	883 (2.1)	90.9§§	1,044 (2.5)	1,310 (3.1)	24.0§§
Hispanic	302 (0.6)	524 (0.9)	50.0§§	1,049 (1.9)	1,299 (2.3)	21.1§§
U.S. Census region of residence						
Northeast	1,485 (2.7)	3,071 (5.6)	107.4§§	2,755 (5.1)	3,461 (6.3)	23.5§§
Midwest	1,319 (2.0)	2,548 (3.9)	95.0§§	3,385 (5.2)	3,959 (6.1)	17.3§§
South	2,087 (1.8)	3,303 (2.8)	55.6§§	2,733 (2.4)	3,722 (3.2)	33.3§§
West	653 (0.8)	658 (0.9)	12.5§§	1,701 (2.2)	1,847 (2.4)	9.1§§

See table footnotes on next page.

the state-specific analyses of opioid deaths are restricted to 28 states, limiting generalizability.

The ongoing epidemic of opioid deaths requires intense attention and action. In a November 2016 report, the Drug Enforcement Administration referred to prescription drugs, heroin, and fentanyl as the most significant drug-related threats to the United States.††† The misuse of prescription opioids is intertwined with that of illicit opioids; data have demonstrated that nonmedical use of prescription opioids is a significant risk factor for heroin use (*10*), underscoring the need for continued prevention efforts around prescription opioids. Intensifying efforts to distribute naloxone (an antidote to reverse an opioid overdose), enhancing access to treatment, including medication-assisted treatment, and implementing harm reduction services are urgently needed. It is important to focus efforts on expanding opioid disorder treatment capacity, including medication-assisted treatment and improving linkage into treatment.§§§ Implementing harm reduction approaches, such as the scaling up comprehensive syringe services programs can reach persons with opioid use disorders and provide them with access to naloxone and medication-assisted treatment, reduce transmission risk for human immunodeficiency virus or hepatitis C, and reduce other harms from drug use. Law enforcement strategies to reduce the illicit opioid supply must also be supported. A recent report did not find evidence that efforts to reduce opioid prescribing were leading to heroin overdoses; rather, such policies could help reduce the number of persons who are exposed to opioids (*7*). Continued improvements in guideline-recommended opioid prescribing practices for chronic pain (*4*), increased improving access to and use of prescription drug monitoring programs, and increased utilization of nonopioid pain treatments are needed. A multifaceted, coordinated approach between public health and public safety is also necessary to address the U.S. opioid epidemic.

††† https://www.dea.gov/resource-center/2016%20NDTA%20Summary.pdf.

§§§ http://aspe.hhs.gov/sites/default/files/pdf/107956/ib_OpioidInitiative.pdf.

TABLE 2. (*Continued*) Number and age-adjusted rate of drug overdose deaths* involving synthetic opioids other than methadone† and heroin,§,¶ by sex, age group, race/ethnicity, U.S. Census region, and selected states†† — United States, 2014 and 2015**

Characteristic	Synthetic opioids other than methadone			Heroin		
	2014	2015	% change in rate, 2014 to 2015	2014	2015	% change in rate, 2014 to 2015
	No. (Rate)	No. (Rate)		No. (Rate)	No. (Rate)	
Selected states††						
States with very good or excellent reporting (n = 21)						
Alaska	14 –¶¶	14 –¶¶	–¶¶	25 (3.3)	37 (4.7)	42.4
Connecticut	94 (2.7)	211 (6.1)	125.9§§	299 (8.9)	390 (11.3)	27.0§§
Iowa	29 (1.0)	44 (1.5)	50.0	37 (1.3)	45 (1.6)	23.1
Maine	62 (5.2)	116 (9.9)	90.4§§	38 (3.1)	52 (4.5)	45.2
Maryland	230 (3.8)	357 (5.8)	52.6§§	313 (5.2)	405 (6.6)	26.9§§
Massachusetts	453 (6.9)	949 (14.4)	108.7§§	469 (7.2)	634 (9.6)	33.3§§
Nevada	32 (1.0)	32 (1.1)	10.0	64 (2.2)	82 (2.7)	22.7
New Hampshire	151 (12.4)	285 (24.1)	94.4§§	98 (8.1)	78 (6.5)	-19.8
New Mexico	66 (3.3)	42 (2.1)	-36.4	139 (7.2)	156 (8.1)	12.5
New York	294 (1.4)	668 (3.3)	135.7§§	825 (4.2)	1,058 (5.4)	28.6§§
North Carolina	217 (2.2)	300 (3.1)	40.9§§	266 (2.8)	393 (4.1)	46.4§§
Oklahoma	73 (1.9)	93 (2.4)	26.3	26 (0.7)	36 (1.0)	42.9
Oregon	33 (0.8)	34 (0.9)	12.5	124 (3.2)	102 (2.5)	-21.9
Rhode Island	82 (7.9)	137 (13.2)	67.1§§	66 (6.8)	45 (4.3)	-36.8
South Carolina	110 (2.3)	161 (3.3)	43.5§§	64 (1.4)	100 (2.2)	57.1§§
Utah	68 (2.5)	62 (2.3)	-8.0	110 (3.8)	127 (4.3)	13.2
Vermont	21 (3.6)	33 (5.6)	55.6	33 (5.8)	33 (5.8)	0.0
Virginia	176 (2.1)	270 (3.3)	57.1§§	253 (3.1)	353 (4.3)	38.7§§
Washington	62 (0.8)	65 (0.9)	12.5	289 (4.1)	303 (4.2)	2.4
West Virginia	122 (7.2)	217 (12.7)	76.4§§	163 (9.8)	194 (11.8)	20.4
Wisconsin	90 (1.6)	112 (2.1)	31.3	270 (4.9)	287 (5.3)	8.2
States with good reporting (n = 7)						
Colorado	80 (1.5)	64 (1.2)	-20.0	156 (2.9)	159 (2.8)	-3.4
Georgia	174 (1.7)	284 (2.8)	64.7§§	153 (1.6)	222 (2.2)	37.5§§
Illinois	127 (1.0)	278 (2.2)	120.0§§	711 (5.6)	844 (6.7)	19.6§§
Minnesota	44 (0.8)	55 (1.0)	25.0	100 (1.9)	115 (2.2)	15.8
Missouri	109 (1.9)	183 (3.1)	63.2§§	334 (5.8)	303 (5.3)	-8.6
Ohio	590 (5.5)	1,234 (11.4)	107.3§§	1,208 (11.1)	1,444 (13.3)	19.8§§
Tennessee	132 (2.1)	251 (4.0)	90.5§§	148 (2.3)	205 (3.3)	43.5§§

Source: CDC. National Vital Statistics System, Mortality. CDC WONDER. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://wonder.cdc.gov/.

* Rates are for the number of deaths per 100,000 population. Age-adjusted death rates were calculated using the direct method and the 2000 standard population. Deaths were classified using the *International Classification of Diseases, Tenth Revision* (ICD–10). Drug overdose deaths were identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14.

† Drug overdose deaths, as defined, that have synthetic opioids other than methadone (T40.4) as contributing causes.

§ Drug overdose deaths, as defined, that have heroin (T40.1) as a contributing cause.

¶ Categories of deaths are not exclusive because deaths might involve more than one drug. Summing categories will result in a number greater than the total number of deaths in a year.

** Data for Hispanic ethnicity should be interpreted with caution; studies comparing Hispanic ethnicity on death certificates and on census surveys have shown inconsistent reporting.

†† Analyses were limited to states meeting the following criteria. For states with very good to excellent reporting, ≥90% of drug overdose death certificates mention at least one specific drug in 2014, with the change in percentage of drug overdose deaths mentioning at least one specific drug differing by <10 percentage points from 2014 to 2015. States with good reporting had 80% to <90% of drug overdose death certificates mention at least one specific drug in 2014, with the change in the percentage of drug overdose deaths mentioning at least one specific drug differing by <10 percentage points from 2014 to 2015. Rate comparisons between states should not be made because of variations in reporting across states.

§§ Statistically significant at p<0.05 level. Gamma tests were used if the number of deaths was <100 in 2014 or 2015, and z-tests were used if the number of deaths was ≥100 in both 2014 and 2015.

¶¶ Cells with nine or fewer deaths are not reported, and rates based on <20 deaths are not considered reliable and not reported.

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Notes from the Field

Outbreak of *Escherichia coli* O157 Infections Associated with Goat Dairy Farm Visits — Connecticut, 2016

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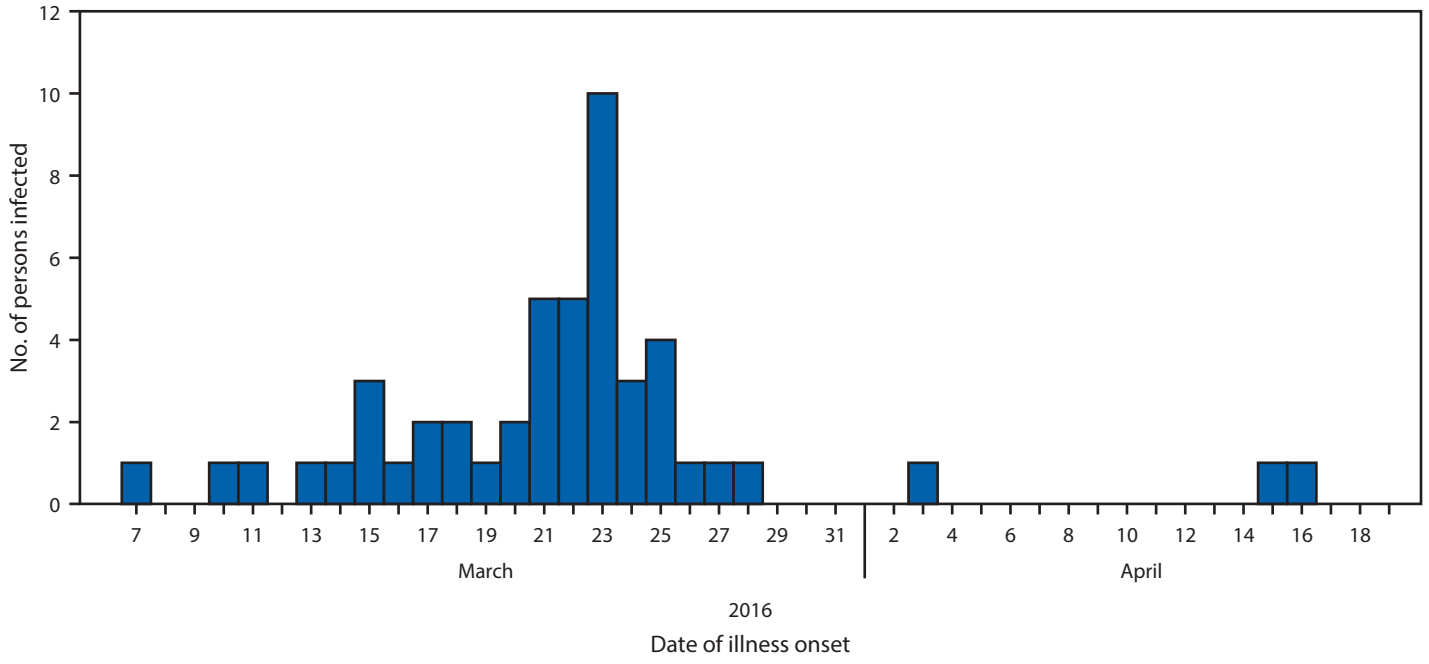
On March 24, 2016, the Connecticut Department of Public Health (DPH) identified a cluster of seven culture-confirmed Shiga toxin–producing *Escherichia coli* (STEC) infections in patients ranging in age from 2 to 25 years. All seven patients reported bloody diarrhea; four were evaluated in an emergency department, three were hospitalized, and two developed hemolytic uremic syndrome (HUS). Six of the seven patients reported visiting the same goat dairy farm in southeastern Connecticut during the week preceding illness onset. An investigation was initiated by DPH, the Connecticut Department of Agriculture, CDC, and the local health district to determine the magnitude of the outbreak, identify risk factors and potential sources of infection, and develop recommendations to prevent further illnesses. A total of 50 confirmed cases of *E. coli* infection were associated with the outbreak, including 47 with an epidemiologic link to the goat farm.

PulseNet, the national molecular subtyping laboratory network for foodborne disease surveillance, and pulsed-field gel electrophoresis (PFGE) were used to identify the outbreak strains as STEC O157. A confirmed case was defined as 1) laboratory-confirmed *E. coli* O157 infection with the PFGE-identified outbreak strain or 2) physician-diagnosed HUS during March–April 2016 in a person with an epidemiologic link to the goat farm. Ill farm visitors were encouraged to contact DPH through a public statement released on March 28, 2016, and were interviewed about their visit. Environmental samples were collected at the farm and cultured, and the resulting bacterial isolates were compared with patient isolates using PFGE and whole genome sequencing. Genetic relatedness of isolates was determined by high-quality single nucleotide polymorphism analysis. The 2013 *Compendium of Measures to Prevent Disease Associated with Animals in Public Settings* was used to evaluate practices at the farm (*1*).

An estimated 1,500 persons visited the farm during March 5–24, 2016, before a legal order was issued by the local health district to halt public visits. A total of 50 confirmed cases of STEC O157 were associated with the outbreak, including 40 (80%) in symptomatic persons who had visited the farm or had contact with goats from the farm, and six (12%) in persons who had contact with someone who had visited the farm. Of the 50 persons with confirmed cases, three did not have an epidemiologic link to the goat farm, and one had visited the farm but was asymptomatic (Figure).

FIGURE. Number of persons infected with the outbreak strain of Shiga toxin–producing *Escherichia coli* O157 for whom information was reported (n = 49*), by date of illness onset — Connecticut, 2016



* One person was laboratory-confirmed with the outbreak strain but was asymptomatic.

Median age of the patients was 5 years (range = 10 months–50 years). Eleven (22%) of the 50 persons were hospitalized, and three (6%) developed HUS.

Investigators obtained 61 environmental samples; among these, 28 (46%) yielded STEC O157. Sixteen of 17 fecal samples collected from goats yielded STEC O157. All environmental, fecal, and clinical isolates were indistinguishable from one another by PFGE and closely related genetically by whole genome sequencing (single nucleotide polymorphism range = 0–5). Facility design at the farm allowed for direct contact with goats and soiled bedding, and the farm did not have hand washing stations or signage to inform visitors of potential disease risks, as recommended by the *Compendium* (*2*).

This investigation highlights the risks to farm visitors, especially young children, from direct contact with animals such as goats and soiled animal bedding in the absence of infection prevention measures. The absence of hand washing stations might have contributed to the outbreak among farm visitors. Soap and clean running water should always be used to wash hands, which should be dried with clean towels immediately upon exiting areas containing animals (*2*). Because STEC O157 is known to colonize the gastrointestinal tract of healthy ruminants, including goats, which can then contaminate animal areas, standard procedures for cleaning and disinfection of exhibition areas, including equipment, should be adopted by animal contact venues to minimize the risks for exposure to STEC O157 (*2*). Facilities also might consider limiting access to potentially contaminated areas for persons at increased risk for severe STEC infections, including young children.

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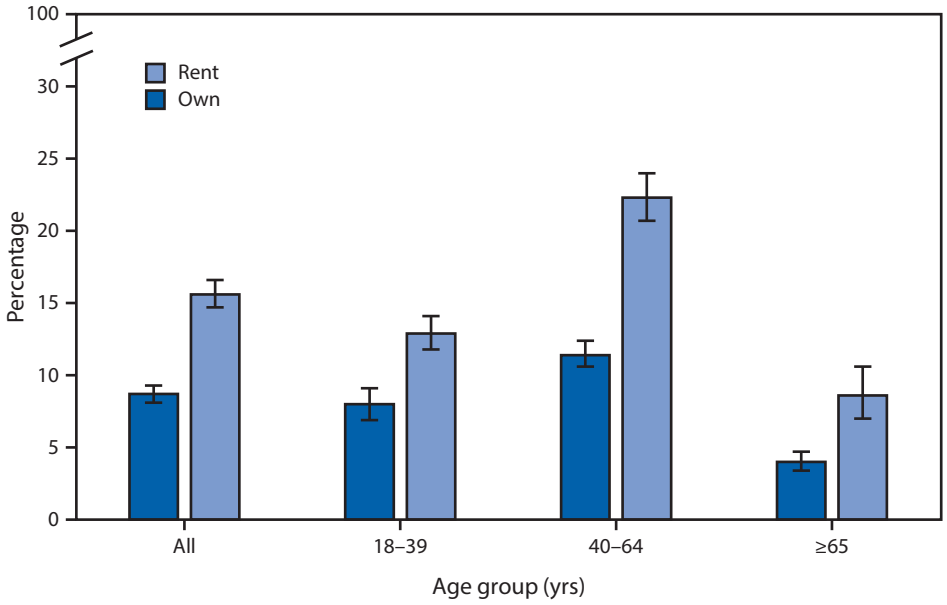
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Are Very Worried about Medical Costs,† by Home Ownership§ and Age Group — National Health Interview Survey,¶ United States, 2015



* With 95% confidence intervals indicated with error bars.
† Based on the response "very worried" to the question on sample adult questionnaire, "How worried are you right now about not being able to pay medical costs for normal healthcare?" Other categories included: "Moderately worried," "Not too worried," "Not worried at all." Unknowns were included in the denominators when calculating percentages.
§ Defined by family respondent's response to question on family core questionnaire, "Is this house/apartment owned or being bought, rented, or occupied by some other arrangement by [you/or someone in your family]?"
¶ Estimates are based on household interviews of a sample of the noninstitutionalized, U.S. civilian population and are derived from the National Health Interview Survey family core and sample adult components.

In 2015, 15.6% of adults who lived in rental houses/apartments were very worried about paying for medical costs, compared with 8.7% of adults who lived in family-owned homes. Adults aged 18–39 years who lived in rental homes were more likely than those in family-owned homes to be very worried about paying medical costs (12.9% versus 8.0%). Among adults aged 40–64 years and ≥65 years, renters were twice as likely as home owners to be very worried about medical costs (22.3% versus 11.4%, and 8.6% versus 4.0%, respectively).

Source: National Health Interview Survey, 2015 data. http://www.cdc.gov/nchs/nhis.htm.

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