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National Black HIV/AIDS Awareness Day — February 7, 2018

National Black HIV/AIDS Awareness Day is observed each year on February 7 to emphasize the continuing disproportionate impact of human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) on the U.S. black/African American (black) population.

In 2014, non-Hispanic blacks represented 12% of the U.S. population (*1*), and the estimated 471,500 blacks living with diagnosed and undiagnosed HIV infection accounted for 43% of all persons living with diagnosed and undiagnosed HIV (*2*). In 2016, blacks represented 12% of the U.S. population (*1*), and blacks with new HIV diagnoses accounted for 44% of all new HIV diagnoses (https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-report-2016-vol-28.pdf).

In 2014, among blacks living with diagnosed HIV infection, in 38 jurisdictions with complete reporting of CD4 and viral load data, 69.8% received HIV medical care, and 51.5% were virally suppressed (viral load test of <200 copies of HIV RNA/mL) (*2*). A study reported in this issue of *MMWR* found racial and ethnic disparities in viral suppression and transmission risk (*3*).

CDC supports a range of efforts to reduce the risk for acquiring or transmitting HIV infection among blacks. Additional information is available at https://www.cdc.gov/features/BlackHIVAIDSAwareness.

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Racial and Ethnic Disparities in Sustained Viral Suppression and Transmission Risk Potential Among Persons Receiving HIV Care — United States, 2014

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Non-Hispanic blacks/African Americans (blacks) represent 12% of the U.S. population.* However, in 2014 an estimated 43% (471,500) of persons living with diagnosed and undiagnosed human immunodeficiency virus (HIV) infection were blacks (*1*). In 2016, blacks accounted for 44% of all new HIV diagnoses (*2*). Although antiretroviral therapy (ART) prescriptions among persons in HIV care increased overall from 89% in 2009 to 94% in 2013, fewer blacks than Hispanics or Latinos

* https://www.census.gov/programs-surveys/popest/data/data-sets.2016.html.

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(Hispanics) and non-Hispanic whites (whites) were on ART and had a suppressed viral load (<200 HIV RNA copies/mL) in their most recent viral load test result (*3*). Blacks also might be less likely to have sustained viral suppression over time and to experience longer periods with viral loads >1,500 HIV RNA copies/mL, a level that increases the risk for transmitting HIV (*4*–*7*). National HIV Surveillance System (NHSS) data are among those used to monitor progress toward reaching the national goal of reducing health disparities. CDC analyzed NHSS data to describe sustained viral suppression and transmission risk potential by race/ethnicity. Among 651,811 persons with HIV infection diagnosed through 2013 and who were alive through 2014 in 38 jurisdictions with complete laboratory reporting, a lower percentage of blacks had sustained viral suppression (40.8%), than had Hispanics (50.1%) and whites (56.3%). Among persons who were in care (i.e., had at least one viral load test in 2014) and had not achieved sustained viral suppression in 2014, blacks experienced longer periods (52.1% of the 12-month period) with viral loads >1,500 copies/mL, than did Hispanics (47.2%) and white (40.8%). Blacks aged 13–24 years had the lowest prevalence of sustained viral suppression, a circumstance that might increase transmission risk potential. Strengthening interventions that improve access to ART, promote adherence, and address barriers to clinical care and supportive services for all persons with diagnosed HIV infection is important for achieving the national goal of reducing health disparities.

All states, the District of Columbia (DC), and U.S. territories report cases of HIV infection and associated demographic and clinical information to NHSS. CDC analyzed data from NHSS reported through June 2017 from 37 states and DC with complete laboratory reporting. These jurisdictions accounted for 71.9% of persons living with diagnosed HIV infection at the end of 2014 in the United States. This analysis includes persons aged ≥13 years who received a diagnosis of HIV infection by December 31, 2013, most recently resided in one of the 38 jurisdictions, and were alive at the end of 2014. For persons who had two or more viral load tests in 2014, sustained viral suppression was defined as viral load test results of <200 copies of HIV RNA/mL for all tests in 2014. For persons who had only one viral load test in 2014, sustained viral suppression was defined as a viral load test result of <200 copies/mL for the 2014 test and also for the last viral load test in 2013. Both groups were included in the numerator. Persons with partial viral suppression in 2014 (i.e., some, but not all viral load test results <200 copies/mL) were excluded from the numerator but included in the denominator. Persons with no viral load tests in 2014 were presumed not to be suppressed and were excluded from the numerator. The numbers and percentages of persons with sustained, partial, and no viral suppression were calculated. All persons living with diagnosed HIV at the end of 2014 were included in the denominator for determining the percentage with sustained viral suppression.

HIV transmission potential was estimated among persons in care who did not achieve sustained viral suppression and was

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defined as the number of days that a person's viral load was >1,500 copies/mL. The estimated number of days with viral load >1,500 copies/mL was calculated for each person and then was averaged across the analytic cohort (*5*,*6*). Persons with no viral load test in 2014 were considered to be not in care and were not included when calculating transmission potential. Sustained viral suppression and transmission risk potential were assessed by sex, age, and transmission category, stratified by race/ethnicity. Data were adjusted using multiple imputation to account for 17.9% missing HIV transmission categories (*8*).

In the 38 jurisdictions, 651,811 persons with HIV infection diagnosed through 2013 were alive at the end of 2014, including 263,588 (40.4%) blacks, 199,700 (30.6%) whites, 149,117 (22.9%) Hispanics, and 39,406 (6.1%) other racial/ethnic groups (data for other racial/ethnic groups not shown). The median number of viral load tests in 2014 was two, with 356,223 (54.7%) persons having two or more tests, 95,926 (14.7%) having one test, and 199,662 (30.6%) having no test in 2014. The percentage of persons without a viral load test in 2014 was 33.9% among blacks, 29.9% among Hispanics, and 28.2% among whites.

Among all persons living with diagnosed HIV infection in the 38 jurisdictions, 48.4% had sustained viral suppression in 2014. A lower proportion of blacks had sustained viral suppression (40.8%), than did Hispanics (50.1%) and whites (56.3%). Across the sex, age, and transmission category subgroups, the proportion of blacks with sustained viral suppression was lower than that of Hispanics and whites (Table 1). Blacks aged 13–24 years had the lowest prevalence of sustained viral suppression (29.2%).

Among 136,759 persons who were in care in 2014, but did not achieve sustained viral suppression, 89,245 (65%) had at least one viral load test result of >1,500 copies/mL in 2014. Overall, the mean number of days with a viral load >1,500 copies/mL was 176 (48.3% of the 12-month period). The mean number of days with a viral load >1,500 copies/mL was higher among blacks (190 days, 52.1% of the 12-month period) than among Hispanics (172 days, 47.2%) and whites (149 days, 40.8%) (Table 2). Across all sex, age, and transmission category

TABLE 1. Sustained viral suppression* among persons aged >13 years with human immunodeficiency virus (HIV) infection diagnosed through 2013 who were alive at the end of 2014, by race/ethnicity and selected characteristics† — National HIV Surveillance System, 37 states and the District of Columbia,§,¶ 2014

	Racial/Ethnic group, No. (%)							
	All groups**		Black		Hispanic/Latino		White	
Characteristic	Total	Sustained viral suppression	Total	Sustained viral suppression	Total	Sustained viral suppression	Total	Sustained viral suppression
Total	**651,811 (100.0)**	**315,390 (48.4)**	**263,588 (100.0)**	**107,438 (40.8)**	**149,117 (100.0)**	**74,721 (50.1)**	**199,700 (100.0)**	**112,413 (56.3)**
Sex								
Male	**500,057 (76.7)**	246,950 (49.4)	**175,170 (66.5)**	70,398 (40.2)	**118,621 (79.5)**	59,235 (49.9)	**175,690 (88.0)**	100,820 (57.4)
Female	**151,754 (23.3)**	68,440 (45.1)	**88,418 (33.5)**	37,040 (41.9)	**30,496 (20.5)**	15,486 (50.8)	**24,010 (12.0)**	11,593 (48.3)
Age group at diagnosis (yrs)								
13–24	**27,825 (4.3)**	9,380 (33.7)	**16,328 (6.2)**	4,769 (29.2)	**6,086 (4.1)**	2,470 (40.6)	**3,544 (1.8)**	1,461 (41.2)
25–34	**95,460 (14.6)**	38,714 (40.6)	**45,207 (17.2)**	15,297 (33.8)	**24,744 (16.6)**	11,022 (44.5)	**19,058 (9.5)**	9,389 (49.3)
35–44	**144,068 (22.1)**	66,250 (46.0)	**58,074 (22.0)**	22,885 (39.4)	**38,286 (25.7)**	18,469 (48.2)	**37,869 (19)**	19,819 (52.3)
45–54	**223,990 (34.4)**	114,726 (51.2)	**83,043 (31.5)**	36,480 (43.9)	**49,524 (33.2)**	25,893 (52.3)	**78,538 (39.3)**	45,208 (57.6)
≥55	**160,468 (24.6)**	86,320 (53.8)	**60,936 (23.1)**	28,007 (46.0)	**30,477 (20.4)**	16,867 (55.3)	**60,691 (30.4)**	36,536 (60.2)
Transmission category								
Male								
Male-to-male sexual contact	**357,258 (54.8)**	185,535 (51.9)	**107,769 (40.9)**	44,248 (41.1)	**82,991 (55.7)**	43,790 (52.8)	**144,148 (72.2)**	85,041 (59.0)
Injection drug use	**54,485 (8.4)**	21,559 (39.6)	**26,708 (10.1)**	9,815 (36.7)	**15,971 (10.7)**	6,346 (39.7)	**9,338 (4.7)**	4,201 (45.0)
Male-to-male sexual contact and injection drug use	**39,225 (6.0)**	18,530 (47.2)	**11,747 (4.5)**	4,796 (40.8)	**8,724 (5.9)**	4,030 (46.2)	**15,640 (7.8)**	8,192 (52.4)
Heterosexual contact	**43,859 (6.7)**	19,313 (44.0)	**26,749 (10.1)**	10,886 (40.7)	**9,674 (6.5)**	4,566 (47.2)	**5,156 (2.6)**	2,687 (52.1)
Female								
Heterosexual contact	**110,865 (17.0)**	51,331 (46.3)	**67,415 (25.6)**	28,851 (42.8)	**21,754 (14.6)**	11,563 (53.2)	**15,459 (7.7)**	7,774 (50.3)
Injection drug use	**36,267 (5.6)**	15,472 (42.7)	**18,556 (7.0)**	7,426 (40.0)	**7,580 (5.1)**	3,481 (45.9)	**7,846 (3.9)**	3,511 (44.7)
Other	**9,853 (1.5)**	3,651 (37.1)	**4,644 (1.8)**	1,417 (30.5)	**2,424 (1.6)**	945 (39.0)	**2,112 (1.1)**	1,007 (47.7)

* Defined as all viral load test results <200 HIV RNA copies/mL in 2014. The cutoff value of <200 HIV RNA copies/mL was based on the U.S. Department of Health and Human Services recommended definition of virologic failure (i.e., failure of ART to suppress a viral load to <200 copies/mL).

† Because the column totals were calculated independently of the corresponding values for each population group, the individual values might not sum to the totals.

§ The 38 jurisdictions were Alabama, Alaska, California, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

¶ Percentages for the totals are column percentages; viral suppression percentages are row percentages.

** Includes all racial/ethnic groups (blacks, Hispanics/Latinos, whites, and others).

TABLE 2. Transmission risk potential* among persons aged ≥13 years with human immunodeficiency virus (HIV) infection diagnosed through 2013 who were alive at the end of 2014, by race/ethnicity and selected characteristics — National HIV Surveillance System, 37 states and the District of Columbia,† 2014

	Mean no. of days during 2014 with viral load >1,500 copies/mL			
Characteristic	Overall§ (n = 136,759)	Black (n = 66,677)	Hispanic/ Latino (n = 29,684)	White (n = 31,033)
Total	**176**	**190**	**172**	**149**
Sex				
Male	174	191	171	145
Female	184	188	175	173
Age group at diagnosis (yrs)				
13–24	211	216	209	192
25–34	204	212	198	187
35–44	186	197	179	170
45–54	164	179	160	142
≥55	136	156	131	103
Transmission category				
Male				
Male-to-male sexual contact	171	195	170	138
Injection drug use	172	178	166	159
Male-to-male sexual contact and injection drug use	183	189	182	176
Heterosexual contact	178	187	167	142
Female				
Heterosexual contact	182	188	171	165
Injection drug use	184	185	179	186
Other	199	209	206	151

* Defined as number of days with a viral load above 1,500 HIV RNA copies/mL during a 12-month period in 2014. Risk for transmission increases when viral load >1500 copies/mL.

† The 38 jurisdictions were Alabama, Alaska, California, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

§ Includes all racial/ethnic groups (blacks, Hispanics/Latinos, whites, and others).

subgroups, blacks experienced a longer percentage of time during 2014 with viral loads >1,500 copies/mL than did Hispanics and whites (Figure). Blacks aged 13–24 years experienced the highest percentage of time with viral load >1,500 copies/mL (216 days, 59% of the 12-month period).

Discussion

Viral suppression is essential to maintaining the health of persons living with HIV infection and reducing the likelihood of HIV transmission. National treatment guidelines recommend that all persons with diagnosed HIV infection, regardless of their viral load or CD4 level, take ART to achieve viral suppression.† However, only 40.8% of blacks living with diagnosed HIV infection in 38 jurisdictions with complete laboratory reporting had sustained viral suppression in 2014, a percentage lower than that among Hispanics (50.1%) and whites (56.3%). The remaining 59.2% of blacks included 25.3% who were in care but did not have sustained viral suppression in 2014 (i.e., partial suppression or not suppressed) and 33.9% with no viral load tests in 2014. The latter is an indication of not receiving adequate HIV care and presumably not having suppressed viral load. Among those in care, blacks experienced a longer period (i.e., half of the time during the 12-month period) with a viral load >1,500 copies/mL, a circumstance which can adversely affect health outcomes and pose a risk for further transmission. Although prescription of ART increased among blacks who received HIV clinical care from 2009 to 2013, fewer blacks received an ART prescription (92.9%) than did Hispanics (95.2%) and whites (95.2%) (*3*). These findings highlight areas for improvement in care retention and offering of ART to all persons with HIV infection according to the national treatment guidelines.

The racial/ethnic differences in sustained viral suppression were present across all sex, age, and transmission categories,

† https://aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf.

Summary

What is already known about this topic?

African Americans/Blacks (blacks) accounted for a disproportionally high percentage of persons living with diagnosed human immunodeficiency virus (HIV) infection in 2014. Between 2009 and 2013, antiretroviral therapy prescriptions have increased more among blacks who received HIV clinical care compared with Hispanics and whites. However, fewer blacks received antiretroviral therapy prescriptions compared with other racial/ethnic groups, and more blacks did not have a suppressed viral load.

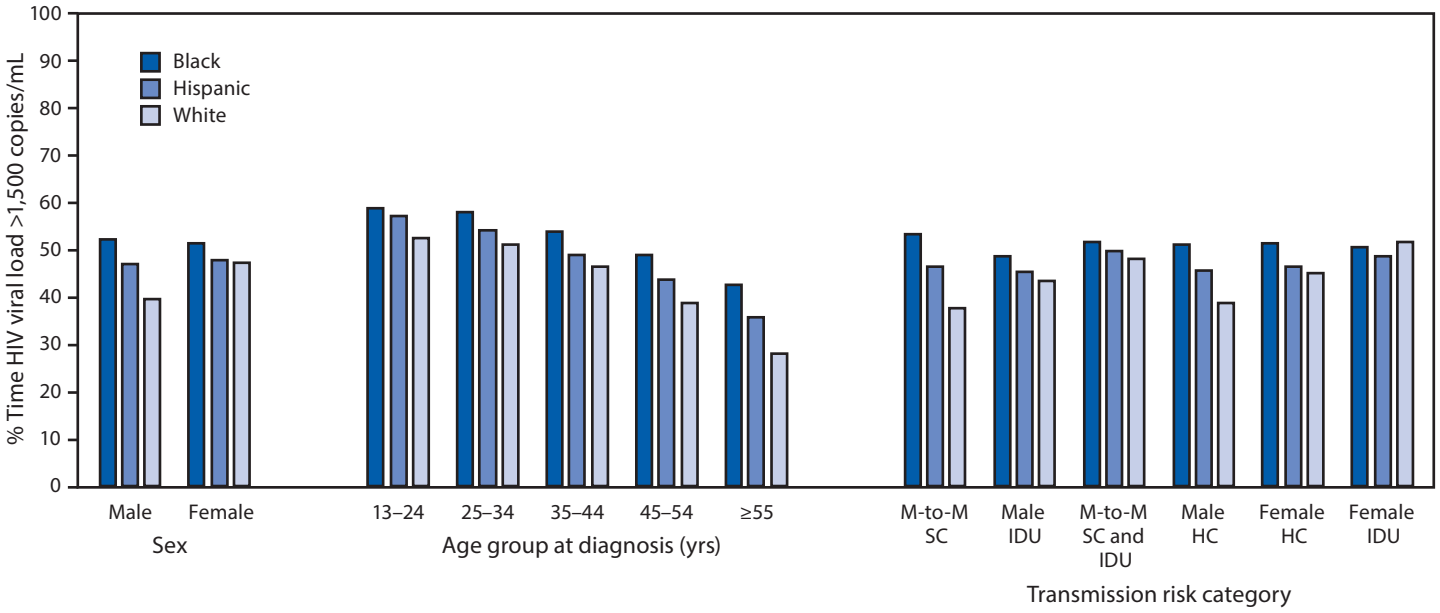
What is added by this report?

In 2014, fewer blacks living with diagnosed HIV infection had sustained viral suppression (all viral load test results in 2014 <200 HIV RNA copies/mL) compared with Hispanics and whites. Among those who were in care and did not achieve sustained viral suppression, blacks had viral loads >1,500 copies/mL for approximately half of the 12-month period in 2014; this circumstance can adversely affect their health outcomes and pose a risk for further transmission. Blacks aged 13–24 years had the lowest prevalence of sustained viral suppression.

What are the implication for public health practice?

Collaboration among health care providers, community-based organizations, and state and local health departments to strengthen programs that address barriers to HIV care, antiretroviral therapy prescription, medication adherence, and sustained viral suppression among blacks, especially blacks aged 13–24 years, could be beneficial in eliminating racial/ethnic disparities.

FIGURE. Percentage of time during 2014 when human immunodeficiency virus (HIV) viral load was >1,500 copies/mL among persons aged ≥13 years with HIV infection, diagnosed through 2013 and who were alive at the end of 2014 by race/ethnicity, sex, age group, and transmission risk category — 37 states and the District of Columbia, 2014



Abbreviations: HC = heterosexual contact; IDU = injection drug use; M-to-M = male-to-male; SC = sexual contact.

and the lowest prevalence of sustained viral suppression was found among blacks aged 13–24 years. Lower viral suppression, combined with the higher prevalences of HIV among blacks compared with other racial/ethnic groups, could lead to a higher HIV transmission risk potential. Barriers such as lack of health insurance, limited access to health services, stigma, health literacy, and lack of trust in providers and the care system might be contributing to these disparities (*9*). Addressing barriers to care and treatment is important to improving the health of persons living with HIV and reducing disparities.

The findings in this report are subject to at least three limitations. First, analyses were limited to 38 jurisdictions with complete reporting of all levels of CD4 and viral load test results; these jurisdictions might not be representative of all persons living with diagnosed HIV infection in the United States. Second, persons might have moved out of a jurisdiction after their latest address was recorded in the 38 jurisdictions, and this migration might contribute to missing viral load records. Finally, 30.6% of 651,811 persons living with a diagnosis of HIV did not have any viral load test in 2014 and were not included in the analysis for transmission risk potential. Many of these persons might not have had a suppressed viral load and might have experienced longer periods with viral loads >1,500 copies/mL. The transmission risk potential for this group is likely to be high, but cannot be determined because of unavailability of viral load data.

Addressing ongoing racial/ethnic disparities in sustained viral suppression is important to efforts to reduce HIV infections in the United States. CDC is pursuing a high-impact prevention approach that combines scientifically proven, cost-effective, and scalable interventions, including expanding HIV testing and increasing treatment adherence (*10*) to reduce HIV infections and increase the effectiveness of HIV prevention and care activities. CDC supports projects that aim to reduce undiagnosed infections, improve engagement in care, and increase sustained viral suppression across all racial/ethnic groups. To reach the national goal of reducing health disparities, tailored strategies that address barriers to achieving and sustaining viral suppression among blacks, especially those aged 13–24 years, are needed. Continued collaboration among health care providers, community-based organizations, and state and local health departments might strengthen programs that address those barriers.

Conflict of Interest

No conflicts of interest were reported.

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Cigarette Brand Preference and Pro-Tobacco Advertising Among Middle and High School Students — United States, 2012–2016

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Nearly all adult smokers first try cigarettes before age 18 years (*1*), and adolescents can show symptoms of nicotine dependence within days to weeks of the onset of occasional cigarette smoking (*2*). Having a usual cigarette brand among adolescent smokers could reflect exposure and receptivity to pro-tobacco advertising and tobacco product appeal (*1*). To identify usual cigarette brands smoked among U.S. middle and high school students who were current (past 30-day) cigarette smokers, CDC analyzed data from the 2012–2016 National Youth Tobacco Survey (NYTS). Marlboro, Newport, and Camel were the most commonly reported brands smoked during 2012–2016; in 2016, these three were the brands usually smoked for 73.1% and 78.7% of current cigarette smokers in middle and high school, respectively. These three brands also were the three most commonly identified as having a "favorite cigarette ad" in 2012. Efforts to reduce youth exposure to pro-tobacco advertising could help reduce youth smoking (*1*,*3*).

NYTS is an annual national survey of U.S. students in grades 6–12.* During 2012–2016, sample sizes ranged from 17,711 (response rate = 63.4%) in 2015 to 24,658 (response rate = 73.6%) in 2012 (*4*). Participants were asked, "During the past 30 days, what brand of cigarettes did you usually smoke?" Response options† were "American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Marlboro," "Newport," "Parliament," "Virginia Slims," "I did not smoke a usual brand," "Some other brand not listed here," "I did not smoke a cigarette in the past 30 days," and "Not sure." Responses of "I did not smoke a cigarette in the past 30 days" and "Not sure" were excluded; all other responses were classified as current (past 30-day) cigarette smokers.§ Among current cigarette smokers, any response other than "I did not smoke a usual brand" was classified as having a usual brand.

In the 2012 NYTS only, participants were asked, "What is the name of the cigarette brand of your favorite cigarette ad?" Response options were "American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Marlboro," "Newport," "Some other brand not listed here," "I don't have a favorite cigarette ad," and "Not sure." Any response other than "I don't have a favorite cigarette ad" and "Not sure" was classified as having a favorite cigarette ad. In the 2015 NYTS only, exposure to ads for both regular cigarettes and electronic cigarettes (e-cigarettes) over four media categories was assessed (the Internet, newspapers/magazines, retail stores, and TV/movies). An exposure was classified as reporting seeing ads on the assessed medium "Sometimes," "Most of the time," or "Always."¶ The tobacco product exposed to on each advertising medium was classified as 1) neither e-cigarettes nor cigarettes, 2) e-cigarettes only, 3) cigarettes only, and 4) both e-cigarettes and cigarettes.

Among current cigarette smokers, brand-specific prevalence was calculated overall and by school level, sex, grade, race/ethnicity, and smoking frequency within the past 30 days (a response of 20–30 days was considered frequent; a response of 1–19 days was considered infrequent).** Binary logistic regression was used to assess brand-specific linear trends during 2012–2016, adjusting for grade, sex, and race/ethnicity. For 2012 only, agreement between usual brand and favorite cigarette ad was assessed among 1,807 current cigarette smokers with data available for both indicators. For 2015 only, the proportion of current cigarette smokers reporting having a usual brand†† was stratified by amount of reported ad exposure to pro-tobacco advertising across media types. Chi-squared tests and logistic regression were used to determine subgroup

* The study period was restricted to 2012–2016 because the questions assessing cigarette brand usually smoked had different response options in preceding NYTS survey years.

† Because of small sample sizes, "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Parliament," and "Virginia Slims" were collapsed together into one category ("Other specific brand").

§ Final analytical sample for each year (past 30-day cigarette smokers) was as follows: 2012 (n = 3,292), 2013 (n = 2,377), 2014 (n = 2,386), 2015 (n = 1,823), and 2016 (n = 1,739).

¶ For each specific advertising medium assessed, participants could select any one of the following response options that best described their frequency of exposure: "Never," "Rarely," "Sometimes," "Most of the time," or "Always." Participants could also indicate if they did not use the medium assessed (e.g., "I do not use the Internet"). Participants who answered "Never" or "Rarely," or who indicated they did not use the assessed medium, were classified as nonexposed to that medium; all other responses were classified as exposed.

** Frequency of cigarette smoking was ascertained with the question "During the past 30 days, on how many days did you smoke cigarettes?" Categorical response options were "0 days," "1 or 2 days," "3 to 5 days," "6 to 9 days," "10 to 19 days," "20 to 29 days," and "All 30 days." A response of "0 days" was classified as being a current nonsmoker and was excluded. The remaining response options were dichotomized as infrequent (1–19 days) and frequent (≥20 days) cigarette smokers.

†† Outcome was dichotomized as 0 or 1. Persons who reported having a specific brand they usually smoked ("American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Marlboro," "Newport," "Parliament," "Virginia Slims," or "Some other brand not listed here") were treated as a positive response. Those who responded, "I did not smoke a usual brand" were treated as not having a brand usually smoked. Responses of "Not sure" or "I did not smoke a cigarette in the past 30 days" were excluded.

differences, with statistical significance set at p<0.05. Data were weighted to yield nationally representative estimates.

During 2016, the top three brands usually smoked among current cigarette smokers in all middle school grades combined were Marlboro (38.3%), Newport (21.4%), and Camel (13.4%) (Table). During 2016, 16.5% of middle school current cigarette smokers smoked some other specific brand, and 10.4% had no usual brand. The proportion of current cigarette smokers who smoked Marlboro cigarettes during 2016 was highest among non-Hispanic whites (whites) (54.6%) and lowest among non-Hispanic blacks (blacks) (11.5%; p<0.05). Conversely, the proportion who smoked Newport cigarettes during 2016 was highest among blacks (58.4%) and lowest among whites (7.9%; p<0.05). A higher proportion of female smokers (27.2%) smoked Newport cigarettes than did male smokers (16.6%; p<0.05). Trends during 2012–2016 were not significant for middle school students overall or among subgroups.

TABLE. Brand of cigarettes usually smoked by current (past 30 day)* cigarette smokers in middle and high school, by selected characteristics — National Youth Tobacco Survey, United States, 2012–2016†

	Marlboro		Newport		Camel		Other specific brand§		No usual brand	
	2012	2016	2012	2016	2012	2016	2012	2016	2012	2016
Characteristic	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Middle School										
Total	**37.0 (3.5)**	**38.3 (4.1)**	**17.1 (2.4)**	**21.4 (3.5)**	**17.8 (2.8)**	**13.4 (2.4)**	**17.5 (2.2)**	**16.5 (2.4)**	**10.5 (1.6)**	**10.4 (1.8)**
Sex										
Male	38.0 (4.5)	38.9 (6.0)	14.6 (2.7)	16.6 (3.8)	19.7 (3.8)	14.5 (3.5)	18.0 (2.7)	17.3 (3.9)	9.7 (1.9)	12.6 (2.7)
Female	35.7 (3.9)	37.2 (4.6)	20.5 (3.2)	27.2 (4.3)	15.4 (2.7)	12.3 (2.9)	16.9 (3.0)	15.6 (3.6)	11.6 (2.1)	7.6 (2.4)
Grade										
6	33.8 (4.9)	40.6 (6.3)	19.7 (4.0)	17.4 (4.6)	15.8 (2.8)	13.4 (4.4)	20.7 (4.5)	18.7 (4.6)	10.1 (2.8)	9.9 (3.6)
7	38.4 (5.9)	33.2 (4.8)	16.3 (3.6)	22.5 (4.6)	16.7 (4.1)	15.8 (3.4)	17.8 (3.7)	13.4 (3.3)	10.8 (2.2)	15.1 (3.5)
8	37.6 (3.8)	41.4 (6.2)	16.5 (2.3)	22.4 (4.7)	19.6 (3.8)	11.5 (3.0)	15.8 (3.2)	17.9 (3.6)	10.6 (2.2)	6.9 (1.9)
Race/Ethnicity										
White, non-Hispanic	44.3 (4.8)	54.6 (5.1)	8.5 (2.1)	7.9 (2.8)	20.3 (5.0)	16.1 (3.5)	17.5 (3.3)	9.4 (3.2)	9.4 (2.3)	12.1 (3.6)
Black, non-Hispanic	28.4 (6.9)	11.5 (5.1)	42.7 (6.6)	58.4 (5.6)	3.8 (0.9)	8.6 (4.3)	16.7 (4.8)	15.5 (5.4)	8.4 (3.7)	6.0 (2.8)
Hispanic	33.2 (4.2)	26.5 (4.2)	14.9 (2.6)	21.3 (5.9)	20.8 (5.5)	18.5 (4.4)	18.8 (4.6)	23.8 (5.2)	12.4 (3.0)	9.9 (3.2)
No. of days smoked in past 30 days¶										
Frequent (≥20 days)	44.8 (9.2)	47.5 (11.0)	14.8 (4.0)	9.1 (4.8)	17.8 (6.5)	14.7 (7.9)	19.5 (6.8)	26.6 (9.4)	3.0 (2.2)	2.0 (2.0)
Infrequent (1–19) days	41.6 (4.8)	40.3 (7.6)	19.0 (3.7)	18.6 (5.3)	16.1 (4.1)	17.3 (4.0)	18.5 (3.1)	14.0 (4.5)	4.8 (1.2)	9.9 (4.1)
High School										
Total	**38.5 (1.8)**	**48.8 (2.4)****	**23.1 (2.1)**	**16.6 (1.8)****	**17.8 (1.4)**	**13.3 (1.3)****	**16.4 (1.5)**	**15.4 (1.6)**	**4.1 (0.4)**	**5.9 (0.9)****
Sex										
Male	39.4 (2.1)	50.0 (2.8)**	21.0 (2.0)	16.0 (2.2)	17.0 (1.5)	12.5 (1.7)**	17.4 (1.8)	15.6 (2.1)	5.1 (0.7)	5.8 (1.2)
Female	37.5 (2.3)	48.0 (3.5)**	26.0 (2.7)	16.8 (2.4)**	18.6 (2.1)	14.2 (1.9)**	15.2 (1.7)	15.0 (1.9)	2.7 (0.5)	6.0 (1.2)**
Grade										
9	34.3 (2.6)	42.9 (3.7)**	25.1 (2.7)	18.4 (2.8)	17.4 (2.2)	15.9 (3.6)	16.2 (1.5)	17.4 (3.1)	6.9 (1.4)	5.4 (1.5)
10	37.2 (2.4)	45.7 (3.7)**	25.5 (3.1)	19.5 (3.0)	19.4 (2.3)	14.2 (3.9)**	14.9 (1.8)	13.9 (1.7)	2.9 (0.7)	6.8 (2.3)**
11	40.3 (2.7)	50.8 (4.4)	22.5 (2.7)	17.2 (3.1)	14.5 (1.6)	10.0 (1.9)	19.0 (2.2)	15.6 (1.5)	3.8 (0.8)	6.4 (1.5)
12	41.1 (2.5)	53.2 (3.7)**	20.3 (2.4)	12.7 (2.0)	19.8 (2.5)	13.6 (1.8)**	15.5 (2.9)	15.3 (2.6)	3.3 (0.6)	5.1 (1.2)**
Race/Ethnicity										
White, non-Hispanic	45.8 (2.1)	59.5 (3.1)**	15.4 (1.8)	9.5 (1.6)**	19.6 (1.9)	11.9 (1.9)**	15.4 (2.0)	14.1 (2.1)	3.7 (0.6)	5.0 (1.4)
Black, non-Hispanic	10.3 (2.7)	11.0 (3.6)	67.0 (4.3)	47.5 (7.6)	4.2 (1.7)	8.9 (3.0)	16.9 (2.7)	16.7 (5.6)	1.6 (0.7)	15.9 (2.5)**
Hispanic	36.6 (2.6)	40.5 (3.2)	20.5 (3.0)	20.2 (3.3)	20.7 (2.3)	18.1 (2.1)	17.8 (2.3)	16.5 (2.0)	4.4 (1.3)	4.7 (1.4)
No. of days smoked in past 30 days¶										
Frequent (≥20 days)	42.2 (2.8)	59.1 (5.1)**	25.6 (2.9)	12.5 (3.4)	18.2 (2.3)	14.0 (2.7)	12.7 (1.9)	11.5 (2.7)	1.3 (0.4)	2.9 (1.3)
Infrequent (1–19 days)	37.8 (2.4)	50.8 (3.5)**	21.6 (2.3)	17.1 (2.5)	19.8 (2.3)	12.4 (2.2)**	18.0 (2.2)	16.6 (2.2)	2.8 (0.6)	3.1 (1.1)

Abbreviation: SE = standard error.

* Assessed with the question: "During the past 30 days, what brand of cigarettes did you usually smoke?" Response options were "American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Marlboro," "Newport," "Parliament," "Virginia Slims," "I did not smoke a usual brand," "Some other brand not listed here," "I did not smoke a cigarette in the past 30 days," and "Not sure." Any response other than "I did not smoke a cigarette in the past 30 days" or "Not sure" was treated as being a current (past 30-day) cigarette smoker.

† Trend analyses include data for 2012, 2013, 2014, 2015, and 2016. Prevalence estimates are presented only for 2012 and 2016.

§ Because of small sample sizes, the responses "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Parliament," and "Virginia Slims" were combined together as one category ("Other specific brand").

¶ Assessed with the question "During the past 30 days, on how many days did you smoke cigarettes?" Response options included "0 days," "1 or 2 days," "3 to 5 days," "6 to 9 days," "10 to 19 days," "20 to 29 days," and "All 30 days." Responses of "0 days" were excluded. All other responses were dichotomized as frequent (≥20 days) or infrequent (1–19 days).

** Statistically significant linear trend during 2012–2016 (p-trend<0.05).

Among high school current cigarette smokers, the top three brands usually smoked by students in all grades combined in 2016 also were Marlboro (48.8%), Newport (16.6%), and Camel (13.3%) (Table). During 2016, 15.4% of high school current cigarette smokers smoked other specific brands, and 5.9% reported no usual brand. As was the case among middle school students, Newport was the most prevalent brand among black high school students (47.5% in 2016), and Marlboro was the most prevalent brand among white high school students (59.5% in 2016). During 2016, the proportion of high school current cigarette smokers that smoked Camel cigarettes was highest among Hispanics (18.1%) and lowest among blacks (8.9%). Trend analyses during 2012–2016 indicated an increase in the prevalence of Marlboro smoking for all high school students (38.5% to 48.8%), males (39.4% to 50.0%), females (37.5% to 48.0%), ninth graders (34.3% to 42.9%), 10th graders (37.2% to 45.7%), 12th graders (41.1% to 53.2%), whites (45.8% to 59.5%), and both frequent (42.2% to 59.1%) and infrequent smokers (37.8% to 50.8%) (all p-values for trend <0.05). The prevalence of Newport smoking declined during 2012–2016 among all high school students (23.1% to 16.6%), females (26.0% to 16.8%), and whites (15.4% to 9.5%) (all p-values for trend <0.05). The prevalence of Camel smoking during 2012–2016 declined among all high school students (17.8% to 13.3%), males (17.0% to 12.5%), females (18.6% to 14.2%), 10th graders (19.4% to 14.2%), 12th graders (19.8% to 13.6%), whites (19.6% to 11.9%), and infrequent smokers (19.8% to 12.4%) (all p-values for trend <0.05). The proportion of students who smoked no usual brand increased among all high school students (4.1% to 5.9%), females (2.7% to 6.0%), 10th graders (2.9% to 6.8%), 12th graders (3.3% to 5.1%), and blacks (1.6% to 15.9%) during 2012–2016 (all p-values for trend <0.05).

In 2012, among current cigarette smokers who reported smoking a usual brand, 72.1% identified the same brand as their favorite cigarette ad. The top three favorite cigarette ads were also the top three brands usually smoked (Figure 1).

In 2015, across all advertising media, current cigarette smokers who reported exposure to neither e-cigarette ads nor cigarette ads reported significantly lower prevalence of having a usual brand than those who reported exposure to both ads (Figure 2). By specific advertising media, among those exposed to neither e-cigarette nor cigarette ads versus both ads, the proportion who reported having a usual brand was as follows: for movies/TV (neither ad = 80.5%; both ads = 94.2%), for retail stores (neither = 69.8%; both = 94.8%), for Internet (neither = 79.4%; both = 94.5%), and for magazines/newspapers (neither = 88.0%; both = 94.6%) (all p-values <0.05).

Summary

What is already known about this topic?

Nearly all adult smokers first try cigarettes before age 18 years. Tobacco-advertising activities, among other factors, including peer influence and price, are associated with initiation of smoking and the continued use of tobacco products among youth.

What is added by this report?

Analysis of 2012–2016 National Youth Tobacco Survey data found that Marlboro, Newport, and Camel were the most commonly reported usual brands smoked by middle and high school current (past 30-day) cigarette smokers. In 2016, these three brands accounted for 73.1% and 78.7% of current cigarette smokers in middle and high school, respectively. Ads for these three brands were also the three most commonly identified "favorite cigarette ad" in 2012. Current cigarette smokers who reported exposure to neither e-cigarette ads nor cigarette ads reported significantly lower prevalence of having a usual brand than those who reported exposure to both ads during 2015.

What are the implications for public health practice?

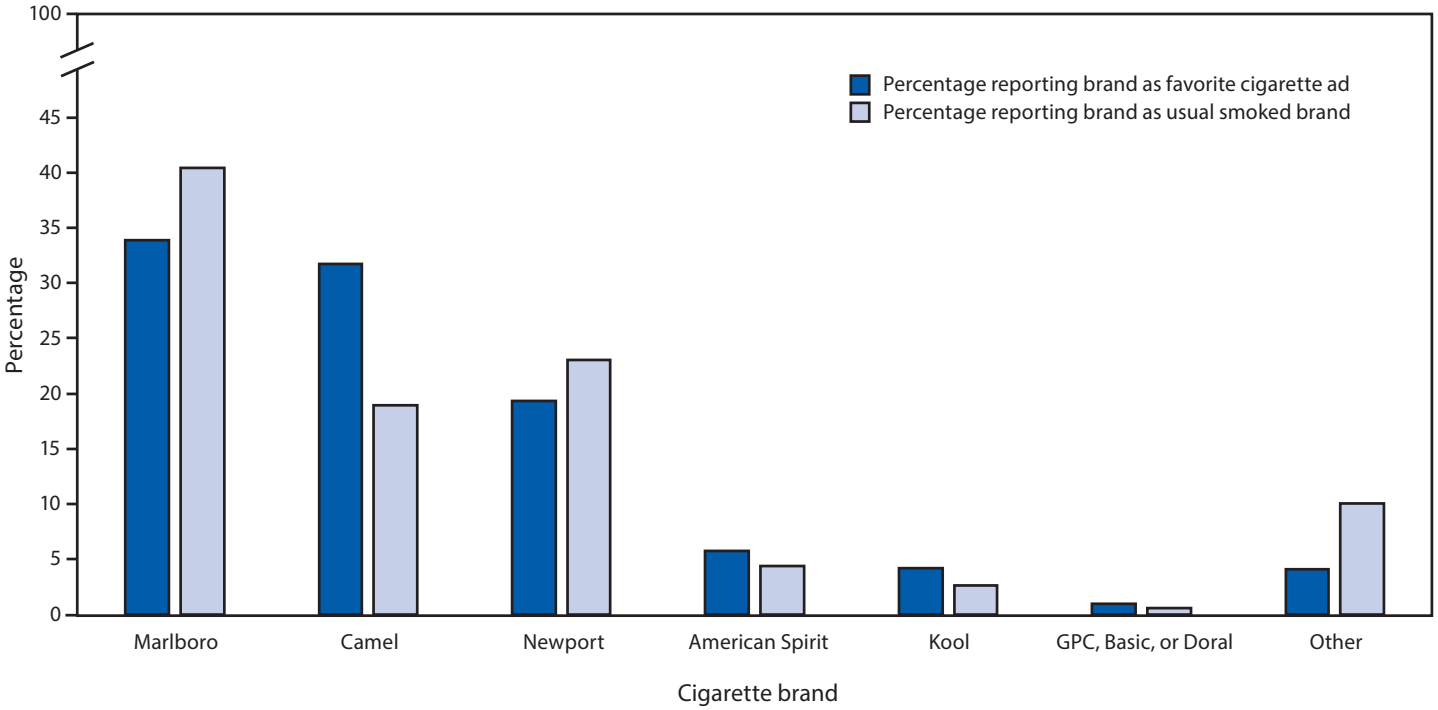
Reducing youth-oriented tobacco marketing, as part of a comprehensive approach in concert with other evidence-based strategies, including comprehensive smoke-free policies, increasing the price of tobacco products, and raising the minimum age of purchase for tobacco products to 21 years, could help reduce the acceptability, affordability, and use of tobacco products among youth.

Discussion

During 2012–2016, the top three brands usually smoked by U.S. middle and high school current cigarette smokers were Marlboro, Newport, and Camel; these brands also were the top three favorite cigarette ads reported by current cigarette smokers in middle and high school in 2012. Market data also indicated that these three brands accounted for the largest share (62%) of the U.S. cigarette market during 2016; the percentage shares of retail volume for Marlboro, Newport, and Camel during 2016 were 40.2%, 13.8%, and 8.0% respectively (*5*). Cigarette ads use youth-oriented themes, including those highlighting independence, rebellion, and perceived social acceptability of cigarette smoking (*3*). Previous epidemiologic studies have demonstrated an association between amount of reported ad exposure and most frequently smoked brands among adolescents (*6*); efforts to reduce youth exposure to pro-tobacco advertising might help reduce smoking initiation among U.S. youth (*1*).

Targeted marketing of tobacco products to certain groups can explain differences in brand preferences among subgroups (*1*,*7*,*8*). Whereas Marlboro smoking was more prevalent among whites, Newport, a predominantly menthol brand, was more often smoked by blacks, which is consistent with previous reports that have documented that menthol cigarettes are marketed to

FIGURE 1. Agreement* between brand of cigarettes usually smoked† and favorite cigarette brand ad§ among middle and high school current (past 30-day) cigarette smokers — National Youth Tobacco Survey, United States, 2012



* Restricted to students who smoked cigarettes during the past 30 days and reported having both a favorite cigarette ad and a cigarette brand usually smoked (n = 1,807). The question on favorite cigarette ad was asked only in 2012.

† Assessed with the question: "During the past 30 days, what brand of cigarettes did you usually smoke?" Responses classified as having a brand usually smoked among past 30-day smokers included "American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Marlboro," "Newport," "Parliament," "Virginia Slims," and "Some other brand not listed here."

§ Assessed with the question: "What is the name of the cigarette brand of your favorite cigarette ad?" Responses classified as having a favorite cigarette ad were "American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Marlboro," "Newport," and "Some other brand not listed here."

specific demographic groups, including blacks (*7*,*8*). Among high school students overall, as well as among females, blacks, and 10th and 12th graders, significant increases were observed in the proportion of smokers reporting no usual brand. Having no usual brand might be an indicator of nonspecific cigarette access patterns, including from social sources such as friends (*1*).

The findings in this report are subject to at least four limitations. First, self-reported cigarette smoking is subject to social desirability bias and might be underreported among youth. Second, both brand preferences and pro-tobacco ad exposure were measured at the same time in this cross-sectional study; the data therefore did not permit assessment of temporality. Exposure to ads could increase brand use or brand use could lead to a favorable impression of tobacco ads. Third, these findings might not be generalizable to youth who are not enrolled in traditional schools, (e.g., dropouts [approximately 6.4% among high school students][§§] and those home-schooled [approximately 3.4% of school-aged children]).[¶¶] Finally, the relationships between "favorite cigarette ad" and cigarette brand preferences as assessed in 2012 NYTS might have limited comparability with subsequent years.

In 2014, U.S. cigarette manufacturers spent approximately $8.5 billion, or approximately $1 million per hour, to advertise and promote cigarettes (*9*). Information on cigarette brand usually smoked can help guide efforts to reduce cigarette smoking among the approximately 1.6 million U.S. middle and high school cigarette smokers (*10*). Reducing youth-oriented tobacco marketing, as part of a comprehensive approach in concert with other evidence-based strategies could help reduce the acceptability, affordability, and use of tobacco products among youth (*1*). Such strategies include comprehensive smoke-free policies, increasing the prices of tobacco products, and raising the minimum age of purchase for tobacco products to 21 years (*1*).

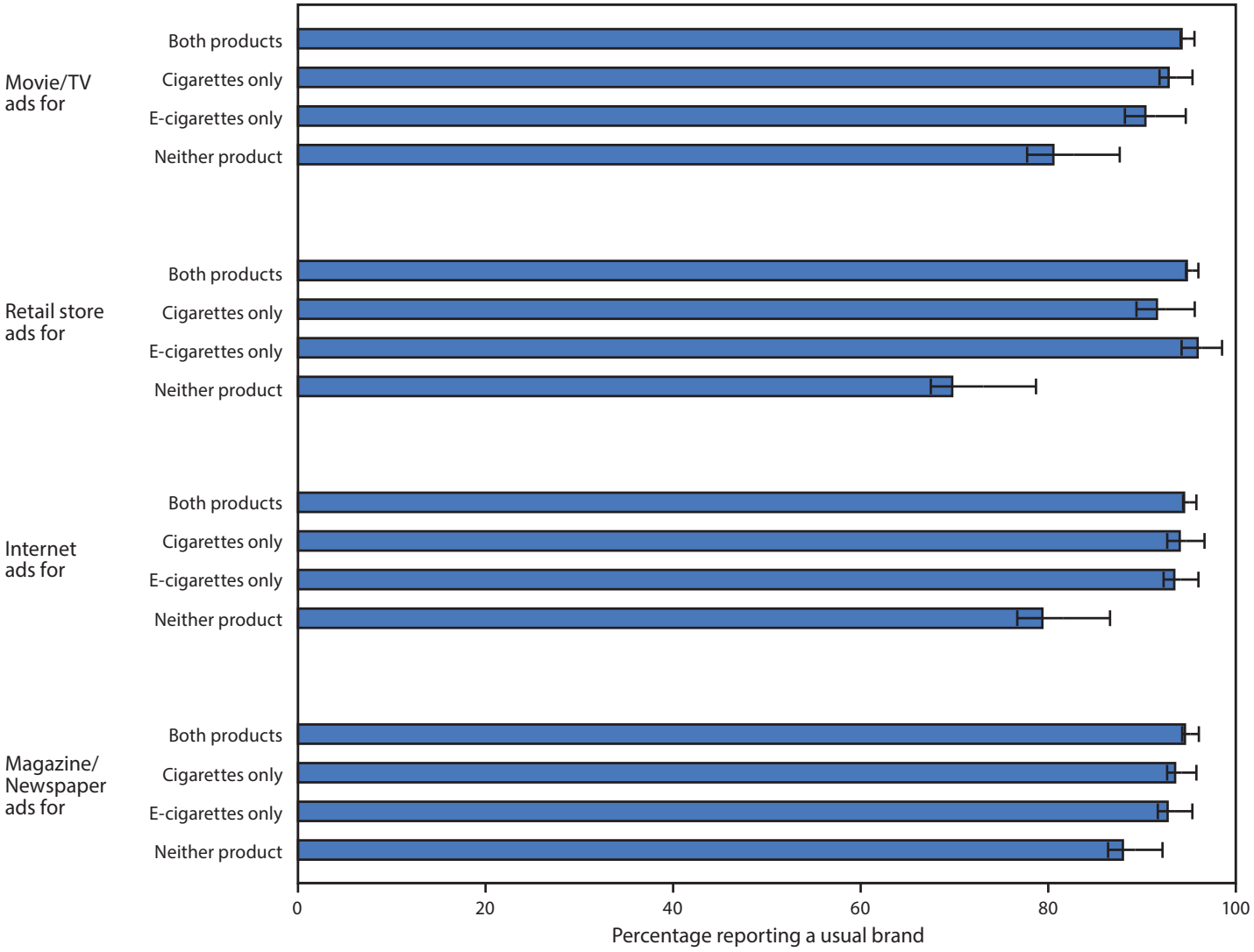
Conflict of Interest

No conflicts of interest were reported.

§§ https://www.census.gov/newsroom/press-releases/2016/cb16-tps142.html.

¶¶ https://nces.ed.gov/programs/digest/d15/tables/dt15_206.10.asp?current=yes.

FIGURE 2. Proportion of middle and high school current (past 30-day) cigarette smokers reporting a usual cigarette brand* by advertising medium and status of exposure to cigarette and/or electronic cigarette ads† — National Youth Tobacco Survey, United States, 2015§



* Outcome was dichotomized as 0 or 1. Persons who reported having a specific brand they usually smoked ("American Spirit," "Camel," "GPC, Basic, or Doral," "Kool," "Lucky Strike," "Marlboro," "Newport," "Parliament," "Virginia Slims," or "Some other brand not listed here") were coded as 1. Those who responded, "I did not smoke a usual brand" were coded as 0. Responses of "Not sure" or "I did not smoke a cigarette in the past 30 days" were excluded.

† Separate questions were asked for electronic cigarettes and regular cigarettes in relation to exposure to pro-tobacco ads on the different media sources (Internet, newspapers/magazines, retail stores, and TV/movies). For both electronic cigarettes and regular cigarettes, respondents' ad exposure status was coded on each medium as either: 1 = exposed (responses of "Sometimes," "Most of the time," and "Always") or 0 = non-exposed ("Never," "Rarely," or those who indicated not using the assessed medium).

§ The questions on exposure to both electronic cigarette and regular cigarette ads were asked only in 2015.

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Acute Illnesses and Injuries Related to Total Release Foggers — 10 States, 2007–2015

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Total release foggers (TRFs) (also known as "bug bombs") are pesticide products often used indoors to kill insects. After an earlier report found that TRFs pose a risk for acute illness (*1*), the Environmental Protection Agency required improved labels on TRFs manufactured after September 2012 (*2*). To examine the early impact of relabeling, the magnitude and characteristics of acute TRF-related illness were evaluated for the period 2007–2015. A total of 3,222 TRF-related illnesses were identified in 10 participating states, based on three data sources: Sentinel Event Notification System for Occupational Risk–Pesticides (SENSOR) programs, the California Department of Pesticide Regulation (CDPR) program, and poison control centers (PCCs) in Florida, Texas, and Washington. No statistically significant decline in the overall TRF-illness incidence rate was found. Failure to vacate treated premises during application was the most commonly reported cause of exposure. To reduce TRF-related illness, integrated pest management strategies (*3*) need to be adopted, as well as better communication about the hazards and proper uses of TRFs. Redesigning TRFs to prevent sudden, unexpected activation might also be useful.

Acute TRF-related illnesses were identified from the SENSOR programs in 10 participating states (2007–2015),* CDPR† (2007–2014), and PCCs in Florida, Texas, and Washington (2007–2015). Complete PCC data were unavailable from the other seven states with SENSOR programs. Cases meeting all of the following criteria were included: exposure to TRFs with known active ingredients, at least two signs or symptoms related to or possibly related to TRF exposure, and no involvement of suicide or intentional harm to others. A total of 3,222 unique cases were identified.§ Cases were categorized as definite, probable, or possible based on case-level evidence.¶ The magnitude, trends, and characteristics of acute TRF-related illnesses were assessed. Incidence rates were calculated using U.S. Census standard population estimates as denominators (*4*). Poisson regression analyses were conducted to estimate incidence rate ratios (IRR) during 2013 (the first full year after label improvement when many TRF products on store shelves likely still had the old labels) and 2014–2015 (the period after label improvement when most TRF products likely had new labels) compared with 2007–2012 (the period before label improvements) for all cases and by reported causes of exposure, controlling for state to adjust for discordance in missing data across states. Stepwise logistic regression analysis was conducted to explore reported causes associated with more severe illness** (high or moderate versus low severity), adjusting for age, sex, and preexisting health conditions.

Overall, 3,573 cases were identified, including 1,843 from the SENSOR and CDPR programs and 1,730 from PCCs in Florida, Texas, and Washington (Table 1); 351 cases were identified from both the SENSOR programs and PCCs in Florida, Texas, or Washington, resulting in a total of 3,222 unique cases. Among cases from the SENSOR and CDPR programs, 87% were reported to the programs by PCCs;

* Under the SENSOR-Pesticides program, CDC provides cooperative agreement funding and technical support to state health departments to conduct surveillance for acute, occupational, pesticide-related illness and injury. Funding support is also provided by the Environmental Protection Agency. In 2017, a total of 13 states participated in this program. Data were available for this study for the period 2007–2013 in Oregon; 2007–2014 in California, Nebraska, and New York; and 2007–2015 in Florida, Louisiana, Michigan, North Carolina, Texas, and Washington. https://www.cdc.gov/niosh/topics/pesticides/overview.html.

† In California, two programs identify cases of acute pesticide-related illness and injury; one is located at the California Department for Public Health (CDPH) and participates in the SENSOR program; the other is the Pesticide Illness Surveillance Program (PISP), administered by CDPR. PISP operates similarly to the SENSOR program, but the case definition and the variables used to characterize cases differ between the two programs (http://www.cdpr.ca.gov/docs/whs/pisp.htm). Although PISP does not formally participate in the SENSOR program, both programs collaborate on joint activities. CDPH collects only work-related cases of acute pesticide-related illness and injury; PISP collects data for work-related and nonwork-related acute pesticide-related illness and injury. To ensure California cases were counted only once, CDPH cross-referenced its cases with those from PISP using name, date of illness and injury and, if available, Social Security number and date of birth.

§ 7,441 persons with TRF exposure were identified, and 3,222 unique cases remained after exclusions. The following persons were excluded: fewer than two signs or symptoms reported (3,638), suicide or intentional harm to others (24), and exposed to TRF products with unknown active ingredients (193). Also, 13 cases were reported by both the California SENSOR program and CDPR, and 351 by both SENSOR programs and PCCs in Florida, Texas, or Washington.

¶ In the SENSOR program, cases are defined as definite (objective evidence is available to confirm exposure and health effects), probable (a combination of objective and self-reported data), and possible (self-reported exposure and health effects data) (https://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef.pdf). Cases from CDPR are categorized as definite (both physical and medical evidence documenting exposure and consequent health effects), probable (limited and circumstantial evidence supporting a relationship to pesticide exposure) and possible (health effects correspond generally to the reported exposure, but evidence is not available to support a relationship). http://apps.cdpr.ca.gov/calpiq/. Case categorization was not available for cases obtained only from PCCs in Florida, Texas, and Washington.

6% were classified as definite, 20% as probable, and 74% as possible. After combining unique cases from the three data sources, the overall incidence rates in the 10 states during 2007–2012, 2013, and 2014–2015 were 27.0, 26.3, and 29.5 per 10 million population, respectively. The adjusted incidence rate did not change in 2013 or 2014–2015, compared with 2007–2012 (Table 2).

Five percent of cases occurred in children aged 0–5 years and 14% in adults aged ≥60 years (Table 1); the median age was 40 years. Approximately 56% occurred in females; 92% of exposures happened in private residences, and 91% were not work-related. Respiratory signs and symptoms (cough, upper respiratory pain or irritation, and dyspnea) and gastrointestinal signs and symptoms (vomiting, nausea, and abdominal pain or cramping) were the most commonly reported. Severity was classified as low, moderate, and high for 78%, 21%, and 0.7% of the illnesses, respectively. Four (0.1%) cases were fatal. Approximately 93% of cases involved exposure to the TRF active ingredients pyrethroid (78%) or pyrethrin (24%). The most commonly reported causes of exposure were failure to vacate treated premises during application, early reentry into treated premises, inability to vacate treated premises before TRF discharge, and inadequate ventilation of treated premises; approximately 4% of cases were caused by TRF discharge by children aged <13 years (Table 1). Incidence rates associated with failure to vacate premises during application increased during 2014–2015 compared with 2007–2012 (adjusted IRR = 1.39, p = 0.002), whereas rates related to excessive fogger use (i.e., using more foggers than necessary) decreased (adjusted IRR = 0.43, p = 0.001) (Table 2). Moderate or high severity illness were more common among males, persons aged >60 years, those with preexisting asthma, and those who failed to vacate premises during application, or who were exposed to excessive TRFs (Table 3).

** Illness and injury severity for SENSOR and CDPR cases was categorized into four groups using the following standardized criteria: low severity (the condition usually resolves without treatment and <3 days are lost from work); moderate severity (the condition is not life-threatening but requires medical treatment; no residual impairment is expected, and time lost from work is ≤5 days); high severity (the condition is life threatening, requires hospitalization, often has >5 days lost from work, and might result in permanent impairment); and fatal (https://www.cdc.gov/niosh/topics/pesticides/statebase.html). For cases from PCCs in Florida, Texas, and Washington, case severity was based on the medical outcomes reported. Those cases reported with "death," "major effect," "moderate effect" and "minor effect" were classified as death, high severity, moderate severity, and low severity, respectively. PCC cases reported with "not followed, minimal clinical effects possible (no more than minor effect possible)" or "unable to follow, judged as a potentially toxic exposure" were also classified as low severity, unless, for those with "unable to follow, judged as a potentially toxic exposure," if the call to the PCC arose from a health care facility and the case had at least two moderate or high severity signs or symptoms (https://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sitablev6.pdf), then the case was classified as moderate severity.

Summary

What is already known about this topic?

Total release foggers (TRFs) pose a risk for acute illness. As a result, the Environmental Protection Agency required manufacturers to place improved labels on all TRFs manufactured after September 2012.

What is added by this report?

During 2007–2015, a total of 3,222 acute TRF-related cases were identified from 10 states participating in the Sentinel Event Notification System for Occupational Risk (SENSOR)–Pesticides program, the California Department of Pesticide Regulation program, and poison control centers in Florida, Texas, and Washington. No statistically significant reduction in overall incidence of TRF-associated injuries and illnesses was observed in the first 3 years after the label revisions took effect. Failure to vacate treated premises during application and early reentry of treated premises were the two most commonly reported causes of TRF-related illness. Failure to vacate the premises and excessive fogger use were associated with moderate or high severity illness.

What are the implications for public health practice?

More comprehensive strategies are needed to reduce acute TRF-related illnesses, including promoting integrated pest management and identifying better approaches for motivating users to read and follow label instructions. Redesigning TRFs to prevent sudden, unexpected activation might also be useful.

Discussion

A previous study identified 466 acute TRF-related illnesses in eight states during 2001–2006 (*1*) for a crude average annual incidence rate of seven cases per 10 million population. This study identified 3,222 cases in 10 states during 2007–2015, with an average annual incidence rate of 27 per 10 million population. This increase likely resulted from including all PCC cases from Florida, Texas, and Washington and conducting a more comprehensive search for TRF-related cases in the SENSOR database. The increase might also partly result from increased TRF use and improved case ascertainment in recent years.

The Environmental Protection Agency required registrants of all TRFs manufactured after September 2012 to adopt improved labels that use pictures to illustrate some instructions and precautions and emphasize actions such as vacating treated premises for at least 2 hours, ventilating treated areas before reentry for an additional 2 hours or until no odor is detected, and not using more foggers than necessary. However, exposure narratives from case reports suggested that many users did not follow or read label instructions. Although many users left the treated area or room, they did not leave the treated premises as specified by the label. Early reentry usually involved entering treated premises shortly after application, often to turn off

TABLE 1. Selected characteristics for acute illnesses and injuries related to total release foggers (TRFs) reported to the Sentinel Event Notification System for Occupational Risk (SENSOR)–Pesticides program, the California Department of Pesticide Registration (CDPR), and poison control centers (PCCs) — 10 states, 2007–2015

	SENSOR and CDPR (n = 1,843)		PCCs (n = 1,730)		Total* (N = 3,222)	
Characteristic	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Reporting state (yrs data available)						
Texas (2007–2015)	38	(2.1)	912	(52.7)	915	(28.4)
Florida (2007–2015)	301	(16.3)	582	(33.6)	658	(20.4)
North Carolina (2007–2015)	467	(25.3)	—	—	467	(14.5)
Michigan (2007–2015)	255	(13.8)	—	—	255	(7.9)
Washington (2007–2015)	107	(5.8)	236	(13.6)	252	(7.8)
California (2007–2014)†	234	(12.7)	—	—	234	(7.3)
Louisiana (2007–2015)	198	(10.7)	—	—	198	(6.2)
New York (2007–2014)	166	(9.0)	—	—	166	(5.2)
Oregon (2007–2013)	55	(3.0)	—	—	55	(1.7)
Nebraska (2007–2014)	22	(1.2)	—	—	22	(0.7)
Year						
2007	155	(8.4)	159	(9.2)	248	(7.7)
2008	229	(12.4)	161	(9.3)	350	(10.9)
2009	273	(14.8)	195	(11.3)	407	(12.6)
2010	231	(12.5)	236	(13.6)	402	(12.5)
2011	227	(12.3)	179	(10.4)	348	(10.8)
2012	247	(13.4)	223	(12.9)	453	(14.1)
2013	183	(9.9)	202	(11.7)	372	(11.6)
2014	163	(8.8)	169	(9.8)	325	(10.1)
2015	135	(7.3)	206	(11.9)	317	(9.8)
Case status						
Definite	105	(5.7)	—	—	105	(3.3)
Probable	366	(19.9)	—	—	366	(11.4)
Possible	1,372	(74.4)	—	—	1,372	(42.6)
Not evaluated	—	—	1,730	(100.0)	1,379	(42.8)
Age group (yrs)						
0–5	95	(5.2)	93	(5.4)	173	(5.4)
6–12	71	(3.9)	84	(4.9)	141	(4.4)
13–17	58	(3.2)	42	(2.4)	90	(2.8)
18–59	1,292	(70.1)	1,100	(63.6)	2,131	(66.1)
≥60	253	(13.7)	245	(14.2)	456	(14.2)
Unknown adult (≥20)	—	—	144	(8.3)	144	(4.5)
Unknown	74	(4.0)	22	(1.3)	87	(2.7)
Sex						
Female	1,017	(55.2)	1,007	(58.2)	1,818	(56.4)
Male	789	(42.8)	713	(41.2)	1,362	(42.3)
Unknown	37	(2.0)	10	(0.6)	42	(1.3)
Location of exposure						
Private residence	1,570	(85.2)	1,641	(94.9)	2,954	(91.7)
Nonmanufacturing commercial site	58	(3.1)	54	(3.1)	99	(3.0)
Other§	88	(4.8)	31	(1.8)	106	(3.3)
Unknown	127	(6.9)	4	(0.2)	63	(2.0)
Work-related exposure						
Yes	162	(8.8)	52	(3.0)	176	(5.5)
No	1,506	(81.7)	1,674	(96.8)	2,946	(91.4)
Unknown	175	(9.5)	4	(0.2)	100	(3.1)
Sites of signs and symptoms¶						
Respiratory	1,423	(77.2)	1,021	(59.0)	2,182	(67.7)
Gastrointestinal	755	(41.0)	997	(57.6)	1,584	(49.2)
Neurologic	652	(35.4)	421	(24.3)	945	(29.3)
Cardiovascular	289	(15.7)	210	(12.1)	460	(14.3)
Ocular	272	(14.8)	229	(13.2)	439	(13.6)
Dermatologic	237	(12.9)	215	(12.4)	406	(12.6)

See table footnotes on next page.

TABLE 1. (*Continued*) Selected characteristics for acute illnesses and injuries related to total release foggers (TRFs) reported to the Sentinel Event Notification System for Occupational Risk (SENSOR)–Pesticides program, the California Department of Pesticide Registration (CDPR), and poison control centers (PCCs) — 10 states, 2007–2015

	SENSOR and CDPR (n = 1,843)		PCCs (n = 1,730)		Total* (N = 3,222)	
Characteristic	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Severity						
Fatal	2	(0.1)	2	(0.1)	4	(0.1)
High	17	(0.9)	8	(0.5)	21	(0.7)
Moderate	352	(19.1)	385	(22.3)	669	(20.7)
Low	1,472	(79.9)	1,335	(77.2)	2,528	(78.5)
Active ingredients involved						
Pyrethroid	1,493	(81.0)	1,298	(75.0)	2,510	(77.9)
Pyrethrin	604	(32.8)	299	(17.3)	773	(24.0)
Organophosphate	120	(6.5)	80	(4.6)	162	(5.0)
Other**	82	(4.5)	65	(3.8)	140	(4.4)
Reported causes of exposure††						
Failure to vacate premises during application	300	(16.3)	201	(17.5)	475	(16.6)
Early reentry	282	(15.3)	150	(13.1)	423	(14.8)
Inability to vacate before TRF discharge	187	(10.2)	128	(11.1)	307	(10.7)
Inadequate ventilation	192	(10.4)	86	(7.5)	263	(9.2)
Sprayed in face or at close range	149	(8.1)	115	(10.0)	258	(9.0)
Excessive fogger use§§	154	(8.4)	22	(1.9)	159	(5.5)
Failure to notify others	101	(5.5)	63	(5.5)	146	(5.1)
Discharge by child aged <13 years	70	(3.8)	61	(5.3)	125	(4.4)
Using TRF as spot spray	58	(3.2)	39	(3.4)	91	(3.2)
Unintentional discharge	24	(1.3)	22	(1.9)	45	(1.6)
Other	163	(8.8)	76	(6.6)	225	(7.9)
Unknown	287	(15.6)	210	(18.3)	485	(16.9)
Not evaluated	—	—	582	(33.6)	357	(11.1)

* SENSOR programs in Florida, Texas, and Washington identified 351 cases that were also reported to PCCs. These cases were counted only once in the total; as such, the case numbers under total might be not equal to the sum of the case numbers under SENSOR and CDPR and PCC.
† Among the 234 cases reported by California, 15 were by CDPH via the SENSOR program, 232 by CDPR, and 13 by both.
§ The most common other locations were vehicles (21), manufacturing facilities (20), and residential institutions (14).
¶ A patient could have signs or symptoms involving multiple sites.
** Other active ingredients were those that did not involve pyrethroids, pyrethrins, or organophosphates. The two most common other active ingredients were N-methyl carbamates (62) and chlorinated hydrocarbons (28). A person could be exposed to a TRF product with multiple active ingredients, thus the sum of cases by active ingredient types exceeds the total number of cases. Among the 3,222 cases, 358 were exposed to more than one of the four categories of active ingredients, and fewer than 5% were exposed to both TRF and non-TRF pesticide products.
†† Exposure narratives were not available for cases provided by Florida PCCs; as such, it was not possible to identify causes of the 357 cases reported to Florida PCCs but not to the SENSOR program. The denominators were the total number of cases with reported causes of exposure, except for the category "not evaluated," for which the denominator was the number of all cases. In addition, a case could have had more than one reported cause of exposure, thus the sum of the rows exceeds the total. The three most commonly reported causes of exposure under the "other" category were contaminated food, drink, utensils, or residue on furniture or surfaces (64); drift (usually from a neighboring apartment unit) (53); and equipment failure (34).
§§ Case narratives indicated more foggers were used than necessary. The label specifies that "one 6-oz can treats up to 5,000 ft^3 of unobstructed space (25 ft x 25 ft x 8 ft ceiling)," and the label cautions, "Do not use more than one fogger per room."

smoke alarms or retrieve pets or forgotten items. Some users were exposed when they entered premises to initiate ventilation. TRF labels do not provide guidance on how to minimize exposure when initiating ventilation. Some users ventilated treated premises for the recommended length of time or longer, but still became ill, suggesting that ventilation might be inadequate or the recommended period might be insufficient to fully eliminate TRF residuals before occupancy. Some were sprayed in the face or at close range because of nozzle malfunction or inappropriate TRF activation (e.g., pointing the nozzle in the wrong direction), suggesting a need for better nozzle designs and a label picture showing how to appropriately set off a TRF.

The reason that the overall illness incidence rate did not decline during 2014–2015 is unknown. Some TRFs used during 2014–2015 might have had old labels, or more time might be needed for the protective effects of the revised labels to be realized. Many users might not have read or followed label instructions. However, incidence rates associated with excessive fogger use did decline, suggesting that simplified label statements and pictures addressing this risk factor might have been effective.

Early reentry likely led to brief exposure to TRF and more commonly caused low severity illnesses, whereas failure to vacate treated premises or excessive fogger use likely resulted in longer or higher concentration exposures and more commonly caused moderate or high severity illnesses. Preexisting asthma was associated with moderate or high severity illnesses, indicating that a warning message for persons with asthma might be

TABLE 2. Incidence of acute total release fogger (TRF)–related illnesses, by reported causes of exposure — 10 states,* 2007–2012, 2013, and 2014–2015

	2007–2012 (before label improvement)		2013 (first year after label improvement)				2014–2015 (after full implementation of label improvement)			
Reported causes of exposure†	No. of cases	Observed rate§	No. of cases	Observed rate§	Adjusted IRR (95% CI)¶	p-value	No. of cases	Observed rate§	Adjusted IRR (95% CI)¶	p-value
Total	**2,208**	**27.0**	**372**	**26.3**	**0.97 (0.84–1.12)**	**0.704**	**642**	**29.5**	**0.91 (0.81–1.02)**	**0.111**
Failure to vacate premises during application	263	4.0	57	4.9	1.20 (0.91–1.59)	0.200	123	7.0	1.39 (1.12–1.71)	0.002
Early reentry	262	4.0	47	3.9	0.98 (0.66–1.45)	0.915	75	4.3	0.89 (0.64–1.23)	0.473
Inability to vacate before TRF discharge	188	3.3	36	3.0	0.98 (0.74–1.30)	0.872	52	3.2	0.86 (0.67–1.10)	0.229
Inadequate ventilation	153	2.6	23	2.1	0.82 (0.44–1.55)	0.549	71	4.5	1.36 (0.89–2.07)	0.155
Sprayed on face or at close range	151	2.6	28	2.3	0.91 (0.57–1.45)	0.685	41	2.6	0.92 (0.62–1.38)	0.700
Excessive fogger use	121	2.2	19	1.8	0.98 (0.65–1.48)	0.934	12	0.9	0.43 (0.26–0.71)	0.001
Failure to notify others	93	1.8	17	1.6	1.05 (0.75–1.48)	0.762	27	1.7	0.77 (0.57–1.03)	0.074
Discharge by child aged <13 years	76	1.8	12	1.2	0.71 (0.39–1.30)	0.269	26	2.3	0.95 (0.62–1.45)	0.797
Use of TRF as spot spray	58	1.2	11	1.4	0.90 (0.50–1.64)	0.735	14	1.1	0.87 (0.51–1.50)	0.614
Unintentional discharge	24	1.0	8	0.9	1.02 (0.62–1.66)	0.950	10	0.9	1.03 (0.67–1.57)	0.906

Abbreviations: CI = confidence interval; IRR = incidence rate ratio; TRF = total release fogger.

* Acute TRF-related illnesses were identified during 2007–2015 from the Sentinel Event Notification System for Occupational Risk (SENSOR)–Pesticides programs in 10 participating states (California, Florida, Louisiana, Michigan, Nebraska, New York, North Carolina, Oregon, Texas, and Washington) and from the California Department of Pesticide Regulation (CDPR) program and poison control centers (PCCs) in Florida, Texas, and Washington.

† Total includes all 3,222 reported cases of acute TRF-related illness. However, for specific reported causes of exposure, Florida cases were excluded because case narratives were not available for any of the 357 Florida PCC cases that were not reported to the SENSOR program. In addition, although the Florida SENSOR program has case narratives available, a trend analysis using Florida data was unreliable because of a sharp drop in reported cases beginning in 2012 that was related to resource limitations. This does not affect the trend analysis for the total because the overall trend includes all Florida PCC cases, and there is no evidence of concerns that would affect reporting to the PCCs (75% [225 of 301] of Florida SENSOR cases that were ascertained by the PCCs and then reported to SENSOR).

§ Per 10 million population, based on U.S. Census standard population estimates. https://www2.census.gov/programs-surveys/popest/tables.

¶ IRR and 95% confidence intervals were estimated by Poisson regression analysis, controlling for state to adjust for discordance in missing data among states and correcting for overdispersion (greater variability than expected based on Poison distribution). Incidence rate during 2007–2012 was the denominator. For each reported cause, a separate Poisson regression analysis was conducted.

necessary on the labels. Although a previous Environmental Protection Agency assessment reported no association between pyrethrin or pyrethroid exposure and asthma (*5*), a recent study found that among persons with acute pesticide-related illness, those with pyrethrin or pyrethroid exposures were significantly more likely to have asthmatic symptoms than were those with other pesticide exposures (*6*).

The findings in this report are subject to at least five limitations. First, because reporting to the surveillance systems and PCCs is passive, and because many persons with low severity cases do not seek medical care, acute TRF-related cases were likely underreported. Second, some cases might be false positives because many of the reported symptoms are not specific to TRF exposure and might have been caused by unrelated factors or conditions. Third, because the number of TRF users or another proxy for TRF users were not available, the overall population in the 10 states was used as the denominator to estimate incidence rates. Trends in incidence rates might be different if the correlation between TRF users and the overall population size was not consistent over time; incidence rates after the label revision would be overestimated if TRF users increased more sharply than the overall population during 2013–2015. Fourth, data were available from only 10 states and might not be representative of the entire United States. Finally, data were available for only 3 years after the new label requirements took effect, and data were missing from four of the 10 states in 2014 or 2015. However, results and conclusions were essentially unchanged when sensitivity analyses were performed that used data from different groups of states (e.g., excluding states with missing data from analysis) and used different post-label periods (e.g., 2014 only and 2015 only). Nonetheless, the evaluation of the early impact from the Environmental Protection Agency's intervention to reduce TRF-related illnesses should be considered preliminary and interpreted with caution.

Additional efforts are needed to prevent acute TRF-related illnesses, including promoting integrated pest management (*3*) to prevent and mitigate pest infestations and identifying more effective strategies to educate users about reading and following label instructions. Redesigning TRFs to prevent sudden, unexpected activation might also be useful.

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TABLE 3. Characteristics related to high or moderate severity of total release fogger–related illnesses reported to the Sentinel Event Notification System for Occupational Risk (SENSOR)–Pesticides program and the California Department of Pesticide Registration — 10 states, 2007–2015

Characteristic	No. of cases	Odds ratio (95% CI)*	p-value
Age group (yrs)			
0–5	95	0.48 (0.24–0.95)	0.034
6–12	71	0.54 (0.26–1.11)	0.092
13–17	58	0.65 (0.31–1.37)	0.260
18–59	1,292	Referent	—
≥60	251	1.70 (1.25–2.32)	0.001
Unknown	74	0.32 (0.13–0.82)	0.017
Sex			
Female	1,015	0.75 (0.59–0.96)	0.020
Male	789	Referent	—
Unknown	37	1.41 (0.51–3.88)	0.51
Preexisting asthma			
Yes	139	2.50 (1.71–3.65)	<0.001
No/Unknown	1,702	Referent	—
Failure to vacate premises during application			
Yes	300	1.57 (1.17–2.11)	0.003
No/Unknown	1,541	Referent	—
Excessive fogger use			
Yes	152	1.54 (1.04–2.27)	0.031
No/unknown	1,689	Referent	—
Early reentry			
Yes	282	0.58 (0.39–0.84)	0.005
No/Unknown	1,559	Referent	—

Abbreviation: CI = confidence interval.

* Odds ratios were estimated using step-wise logistic regression analysis: entry p-value = 0.10 and stay p-value = 0.15. The outcome of interest was high or moderate severity illness compared with low severity illness, and independent variables included age group, sex, three preexisting conditions (pregnancy, preexisting asthma, and history of allergies), and the top 10 reported causes of exposure (failure to vacate premises during application, early reentry, unable to vacate before total release fogger [TRF] discharge, inadequate ventilation, sprayed on face or at close range, excessive TRF use, failure to notify others, within reach of child, using TRF as spot spray, and unintentional discharge); only variables selected for the final regression model are presented in the table. Data from poison control centers in Florida, Texas, and Washington were not included because they did not provide detailed information for this analysis.

Conflict of Interest

No conflicts of interest were reported.

[1]National Institute for Occupational Safety and Health, CDC; [2]Louisiana Department of Health; [3]California Department of Public Health; [4]Public Health Institute, Oakland, California; [5]New York State Department of Health; [6]California Department of Pesticide Registration; [7]North Carolina Division of Public Health; [8]Florida Department of Health; [9]Texas Department of State Health Services; [10]Washington State Department of Health; [11]Michigan Department of Health and Human Services; [12] Nebraska Department of Health and Human Services; [13]Oregon Health Authority.

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Outbreak of Seoul Virus Among Rats and Rat Owners — United States and Canada, 2017

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In December 2016, the Wisconsin Department of Health Services (WDHS) notified CDC of a patient hospitalized with fever, leukopenia, elevated transaminases, and proteinuria. The patient owned and operated an in-home rattery, or rat-breeding facility, with approximately 100 Norway rats, primarily bred as pets. A family member developed similar symptoms 4 weeks later, but was not hospitalized. Because both patients were known to have rodent contact, they were tested for hantavirus infections. In January 2017, CDC confirmed recent, acute Seoul virus infection in both patients. An investigation was conducted to identify additional human and rat infections and prevent further transmission. Ultimately, the investigation identified 31 facilities in 11 states with human and/or rat Seoul virus infections; six facilities also reported exchanging rats with Canadian ratteries. Testing of serum samples from 183 persons in the United States and Canada identified 24 (13.1%) with Seoul virus antibodies; three (12.5%) were hospitalized and no deaths occurred. This investigation, including cases described in a previously published report from Tennessee (*1*), identified the first known transmission of Seoul virus from pet rats to humans in the United States and Canada. Pet rat owners should practice safe rodent handling to prevent Seoul virus infection (*2*).

Seoul virus is an Old World hantavirus in the *Bunyaviridae* family. Its natural reservoir is the Norway rat (*Rattus norvegicus*). Rats infected with Seoul virus are asymptomatic, but can transmit the virus to humans through infectious saliva, urine, droppings, or aerosolization from contaminated bedding. Human signs and symptoms range from mild influenza-like illness to hemorrhagic fever with renal syndrome (HFRS). HFRS causes acute renal failure and can result in death; however, asymptomatic Seoul virus infections also occur. Wild Norway rats in the United States have been known to harbor Seoul virus infection (*3*), but transmission to humans is rare (*4*). Seoul virus is not known to spread from person to person. In the United Kingdom, Seoul virus transmission has occurred from pet rats to humans (*5*), but before this outbreak, infections had not been reported in pet rats in the United States or Canada.

Investigation and Results

After confirming Seoul virus infection in the Wisconsin patients, CDC and WDHS initiated investigations into rat shipments to (trace-back) and from (trace-forward) the rattery to identify suspected and confirmed facilities. Trace-back investigations initially extended back 2 months prior to onset of clinical disease, based on the known maximum incubation period for Seoul virus in humans. As additional confirmed facilities were identified, tracing focused instead on interactions with known infected facilities, sometimes as much as 1 year prior. Suspected facilities included ratteries, homes, or pet stores that sold rats to a confirmed facility (a facility where at least one human or rat tested positive for Seoul virus infection) or housed rats that lived at or comingled with rats from a confirmed facility. Once a suspected facility was identified, local or state health officials interviewed persons with a history of rodent contact associated with the facility about their rat exposure and health history. Additionally, the primary rodent caretaker was interviewed using a standardized questionnaire to identify movement of rats into and out of the facility, including dates and locations where the rats were obtained. Local or state health officials offered laboratory testing for Seoul virus infection to all persons with rodent contact. Officials recommended testing for persons with a history of febrile illness and exposure to rats from a confirmed facility and for rats at suspected and confirmed facilities. Trace-forward and trace-back investigations of rat shipments at confirmed facilities identified additional suspected facilities, which were similarly assessed.

A suspected human case of Seoul virus infection was defined as a febrile illness (recorded temperature >101°F [38.3°C] or subjective history of fever) or an illness clinically compatible with Seoul virus infection (myalgia, headache, renal failure, conjunctival redness, thrombocytopenia, or proteinuria) without laboratory confirmation in a person reporting contact with rats from a confirmed or suspected facility. Human Seoul virus infections were laboratory-confirmed by detection of Seoul virus-specific immunoglobulin M (IgM) and/or immunoglobulin G (IgG) (*6*) antibodies by enzyme-linked immunosorbent assay (ELISA). In the United States, Seoul virus infections in rats were confirmed through detection of viral RNA by reverse transcription–polymerase chain reaction (RT-PCR) and/or IgG ELISA at CDC, or by CDC-validated commercial IgG testing. In Canada, public health officials investigated rat breeding facilities that exported rats to and imported rats from affected U.S. facilities. Seoul virus infection was detected in Canadian rats from breeding facilities using the same serologic and molecular-based protocols described for United States facilities.

By March 16, 2017, trace-forward and trace-back investigations identified approximately 100 suspected facilities in 21 states. Among these, 31 facilities in 11 states* had laboratory-confirmed human or rat infections, including a previously reported household in Tennessee with two confirmed human infections (*1*). Six confirmed facilities in six states (Georgia, Illinois, Missouri, South Carolina, Tennessee, and Utah) reported exchanging rats with Canadian ratteries during their trace-forward and trace-back investigations. A total of 163 persons in the United States and 20 in Canada consented to serologic testing; 17 (10.4%) U.S. residents and one (5.0%) Canadian resident had detectable IgM and IgG antibodies, indicating recent infection, and four (2.5%) U.S. residents and two (10.0%) Canadian residents had only IgG antibodies, indicating past or convalescent infection. Among the 17 U.S. patients with recent Seoul virus infection, eight reported recent febrile illness. Three were hospitalized, but did not develop HFRS, and all recovered. Serious illness was not reported in any Canadian patients. All strains detected in Canada and the United States were indistinguishable from one another based on nucleotide sequencing (*7*), indicating that a single strain was responsible for the outbreak. No single facility was identified as the origin of the outbreak.

Summary

What is already known about this topic?

Seoul virus, a type of hantavirus, is carried by Norway rats. Humans become infected through contact with virus shed in rat urine or droppings, or inhalation of virus particles in dust from contaminated bedding. Infected rats do not develop disease, but humans can experience symptoms ranging from mild influenza-like illness to severe disease with kidney failure and death. Although infections have been previously reported in humans after contact with wild rats, Seoul virus infections had not been reported in pet rats in the United States or Canada.

What is added by this report?

This report describes the first known outbreak of Seoul virus infections in humans from contact with pet rats in the United States and Canada. This investigation identified 31 U.S. facilities with human and/or rat Seoul virus infections in 11 states, including six that exchanged rats with Canadian ratteries. Seventeen persons had recent infection with Seoul virus, eight became ill, and three were hospitalized and recovered.

What are the implications for public health practice?

Human hantavirus infections are reportable to state or local health departments in the United States. Clinicians should consider Seoul virus infection in patients with a history of rat contact and compatible symptoms. Pet rat owners and breeders should also be aware of Seoul virus and should practice good hand hygiene and safe rodent handling to prevent infection.

Public Health Response

On January 24, CDC issued a Health Alert Notice to notify health departments and health care providers of the Seoul virus investigations.† On February 20, the World Health Organization was notified of the U.S. and Canadian infections and investigations as required by International Health Regulations.§ On January 31 and May 9, 2017, CDC and the Pet Industry Joint Advisory Council hosted calls to provide updates on the Seoul virus outbreak and to answer questions for the pet industry and fancy rat community. CDC created a website with Seoul virus facts and frequently asked questions for the public.

Health departments notified suspected and confirmed facilities and placed those facilities under quarantine, allowing no rats to enter or leave. Rat contact was limited to as few persons as possible to reduce transmission. In suspected facilities, CDC recommended rat testing be performed under the supervision of a public health official or licensed veterinarian. The quarantine was lifted when at least 4 weeks had elapsed since the newest animal was introduced, and all rats subsequently tested negative. Rats belonging to owners who refused to test their animals could remain quarantined for life or be euthanized. CDC recommended euthanasia of all rats in confirmed facilities as the most effective method to prevent transmission, although control recommendations differed by state and country according to local policies and response capacities. If euthanasia was not possible, then owners could either quarantine all rats for life or pursue quarantine with testing and culling. The testing and culling strategy entailed testing all rats and euthanizing only infected rats. Testing and euthanasia were repeated at 4 week intervals until all rats tested negative and the quarantine was lifted. In Canada, public health officials opted for education and a voluntary testing and culling approach to control Seoul virus transmission.

Discussion

This outbreak report, in parallel to the previously described investigation in Tennessee (*1*), describes the first known cases of Seoul virus infection in humans attributable to contact with pet rats in the United States and Canada. Human hantavirus infections are nationally notifiable in the United States and suspected cases should be reported to state or local health departments. Health care providers should consider Seoul virus infection in patients with febrile illness who report rat exposure; CDC recommends testing for any person with compatible illness and rodent contact. Testing is available at CDC¶ and

* Colorado, Georgia, Iowa, Illinois, Minnesota, Missouri, Pennsylvania, South Carolina, Tennessee, Utah, and Wisconsin.
† https://emergency.cdc.gov/han/han00400.asp.
§ http://www.who.int/csr/don/20-february-2017-seoulvirus-usa-and-canada/en/.
¶ https://www.cdc.gov/hantavirus/health-care-workers/specimen-submission/index.html.

through some state and commercial laboratories. In Canada, testing is available for symptomatic persons with rat exposure, rattery owners associated with this investigation, and their rats through public health laboratories; for individually owned pet rats and ratteries not associated with the investigation, testing is available through a commercial laboratory.

Pet rat owners should be aware of the potential for Seoul virus infection. To keep themselves and their pets healthy, all persons with rodent contact should avoid bites or scratches and practice good hand hygiene, especially children and persons with compromised immune systems (*2*). CDC recommends hand washing after caring for rodents and before eating, drinking, or preparing food (*2*). If a pet rat is suspected of having Seoul virus, the person cleaning the rodent environment should wear a respirator, gloves, and cover any scratches or open wounds (*8*). An adult should routinely disinfect rat cages and accessories, including used bedding, with a 10% bleach solution or a commercial disinfectant (*8*). More information about rodent contact and disease prevention is available from CDC (*8,9*).

Rattery owners are encouraged to quarantine any newly acquired rats for 4 weeks and to test these rats for Seoul virus antibodies before allowing them to comingle with other rats. Commercial laboratories can perform Seoul virus testing of rodent blood samples, and comparisons of results from shared samples have been concordant with CDC's ELISA and RT-PCR assays. To prevent transmission to humans, CDC recommends euthanasia of all rats in facilities with human or rat Seoul virus infections. Further guidance on methods to eradicate Seoul virus from infected ratteries should be obtained from local or state health departments.

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Conflict of Interest

No conflicts of interest were reported.

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Notes from the Field

Public Health Response to a Human Immunodeficiency Virus Outbreak Associated with Unsafe Injection Practices — Roka Commune, Cambodia, 2016

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Cambodians receive 0.8–5.9 therapeutic injections per person per year, one of the highest reported rates worldwide (*1*,*2*). Appropriate medical injections and infusions can be health sustaining or lifesaving; however, improper administration can have detrimental health consequences, including infectious disease transmission (*3*). In 2000, it was estimated that worldwide, unsafe injection and waste disposal practices account for 260,000 new human immunodeficiency virus (HIV) infections annually (*3*).

A case-control study conducted as part of an investigation of an outbreak of 242 new cases of HIV infection among residents of Roka Commune, Battambang Province, Cambodia, from December 2014 through February 2015, (*4*) identified unsafe medical injection practices by an unlicensed health care practitioner as the likely source of the outbreak, highlighting the potential for unsafe therapeutic injection practices to contribute to HIV transmission in Cambodia. After this outbreak, the government of Cambodia implemented new regulations to prohibit unlicensed medical practices (*5*). Although the outbreak was associated with the unregulated health sector, it prompted an assessment of injection safety practices among licensed health care workers in Cambodia, given the high public demand for medical injections. To identify potential gaps in safe injection practices, the Cambodia Ministry of Health (MOH) partnered with CDC and the medical technology company Becton Dickinson (Franklin Lakes, New Jersey) to conduct a rapid assessment of injection practices at public health facilities.

From September 26–29, 2016, a team of medical officers from CDC and a clinical team from Becton Dickinson with expertise in infection control assisted the Cambodia MOH in implementation of the rapid assessment. A cross-sectional study* was conducted among the 15 main government health care facilities in Battambang and Pursat provinces, which are among the provinces with the highest medical injection rates (*1*) and are in close proximity to the site of the 2014–2015 HIV outbreak. A World Health Organization (WHO) standardized injection practices assessment tool (*6*) was used to interview licensed health care workers, including physicians, nurses, and laboratory technicians, and observe all injections administered. Injection technique was evaluated using a standardized checklist. The interview questions ascertained knowledge, attitudes, and practices regarding injection use and safety. Frequencies were calculated, and, given the limited sample size, exact 95% confidence intervals were estimated using statistical software.

A total of 115 injection events were observed, and 39 health care workers were interviewed (Table); 99% of injections were administered with needles and syringes taken from unopened, sterile packs. However, patient identification was not confirmed before injection in 54% of events, hand hygiene procedures did not precede injection in 79% of events, and a new cotton swab was used in only 36% of events. Observation of safety practices demonstrated that 63% of health care workers recapped needles after use; 51% were recapped with two hands. Less than half (48%) of sharps containers were appropriately placed within arm's length of health care worker; however, most needles (83%) were still placed in a sharps container immediately after use. All 39 interviewed health care workers knew that HIV could be transmitted through unsafe injection practices, but fewer were aware of the potential for transmission of hepatitis B virus (79%) and hepatitis C virus (62%) through this route. Finally, 28% of health care workers reported ever experiencing a needle stick injury, and 49% reported ever receiving formal injection safety training.

Although this study found little reuse of injection equipment and high knowledge of the risks of unsafe injection practices related to HIV transmission, none of the observed injections fully adhered to WHO standards of practice, thus potentially compromising both patient and health care worker safety. To address these gaps, an intensive training curriculum on safe injection practices for health care workers is being developed by Becton Dickinson with technical support from CDC. After review and approval by the Cambodia MOH, expert master trainers will administer this training in the same health care facilities where the baseline assessment was conducted. The impact of the training on the improvement of injection and phlebotomy practices will be measured with a follow-up assessment in the same facilities where the baseline assessment was conducted. Health assessment findings are also contributing to the revision of current policies, information education and communication resources, and the development of job aids on safe injection practices.

* This study was conducted with the approval of the Cambodia National Ethics Committee for Health Research.

TABLE. Assessment of safe injection knowledge, attitudes, and practices among health care workers — Battambang and Pursat provinces, Cambodia, 2016

Assessment component (No. assessed)	No.	% (95% CI)
Observation of injection administration (115)		
Procedures affecting patient safety		
Sterile needle/syringe used for injection (112)	111	99 (95–100)
Patient identification **not** confirmed before injection (113)	61	54 (44–63)
Hand hygiene **not** performed before injection administration (115)	91	79 (71–86)
Injection site cleaned with a newly moistened cotton swab (110)	40	36 (27–46)
Procedures affecting health care worker safety		
Needle recapped after use (104)	65	63 (52–72)
Recapped with two hands (65)	33	51 (38–63)
Sharps container placed within arm's reach of health care worker (106)	51	48 (38–58)
Needle disposed of in sharps container immediately after use (109)	91	83 (75–90)
Health care worker interviews (39)		
Aware of disease transmission via unsafe injections		
Human immunodeficiency virus	39	100 (91–100)
Hepatitis B	31	79 (64–91)
Hepatitis C	24	62 (45–77)
Ever experienced needle-stick injury	11	28 (15–45)
Received formal training on injection safety practices	19	49 (32–65)

Abbreviation: CI = confidence interval.

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Conflict of Interest

No conflicts of interest were reported.

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Notice to Readers

Change in Continuing Education Activities for *MMWR* Weekly

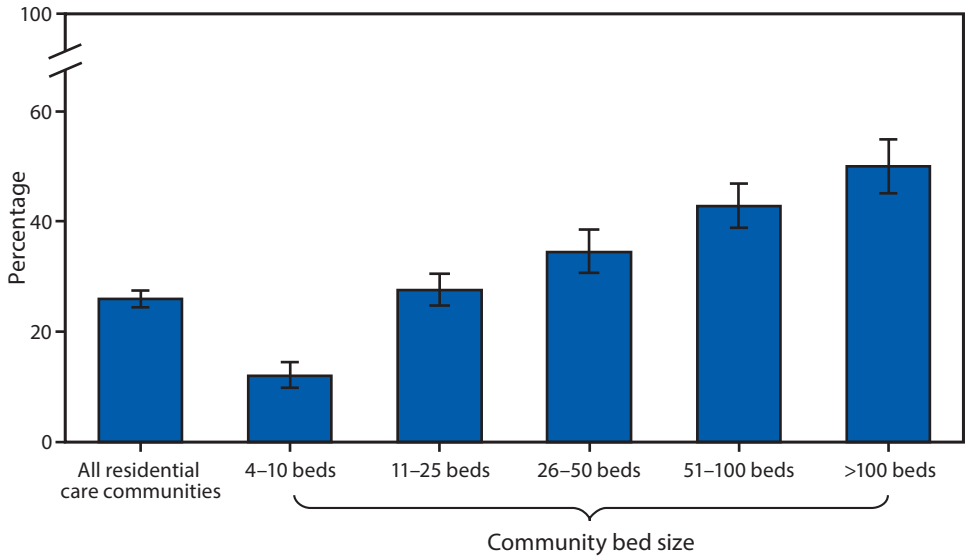
Effective February 1, 2018, *MMWR* Weekly will begin offering Continuing Education (CE) for one report per issue rather than the entire issue. The following types of CE will be available for each report: Continuing Medical Education (CME) for physicians, Continuing Nursing Education (CNE) for nurses, CE for certified health education specialists (CHES), and Continuing Education Units (CEU) for other health professionals. For reports relevant for veterinarians, American Association of Veterinary State Boards/Registry of Approved Continuing Education (AAVSB/RACE) will be available. CE is provided through CDC's Training and Continuing Education Online (TCEO) system.

To obtain CE, users should log in to TCEO (https://www.cdc.gov/tceonline), search by the keyword "MMWR Weekly" to locate the appropriate issue, select the appropriate type of CE, complete the evaluation, and pass the posttest. CE can be obtained for 1 year from the date the activity is available in TCEO. No fee is charged for participating in these CE activities. Questions and comments about *MMWR* CEs can be submitted to mmwrq@cdc.gov.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Residential Care Communities† That Use Electronic Health Records,§ by Community Bed Size¶ — United States, 2016



* With 95% confidence intervals indicated with error bars.
† Residential care communities include those that were state-regulated; had four or more beds; and provided room and board with at least two meals a day, around-the-clock on-site supervision, and help with personal care, such as bathing and dressing or health-related services such as medication management. Residential care communities licensed to exclusively serve the mentally ill or the intellectually disabled/developmentally disabled populations were excluded.
§ Respondents were asked, "An electronic health record is a computerized version of the resident's health and personal information used in the management of the resident's health care. Other than for accounting or billing purposes, does this residential care community use electronic health records?"
¶ Residential care communities with missing data were excluded.

In 2016, one fourth (26%) of residential care communities used electronic health records (EHRs). The percentage of communities that used EHRs increased with community bed size. The percentage was 12% in communities with 4–10 beds, 28% with 11–25 beds, 35% with 26–50 beds, 43% with 51–100 beds, and 50% with >100 beds using EHRs.

Source: National Study of Long-Term Care Providers, 2016. https://www.cdc.gov/nchs/nsltcp/nsltcp_rdc.htm.

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