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Disparities in Adult Cigarette Smoking — United States, 2002–2005 and 2010–2013

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Although cigarette smoking has substantially declined since the release of the 1964 Surgeon General's report on smoking and health,* disparities in tobacco use exist among racial/ethnic populations (*1*). Moreover, because estimates of U.S. adult cigarette smoking and tobacco use are usually limited to aggregate racial or ethnic population categories (i.e., non-Hispanic whites [whites]; non-Hispanic blacks or African Americans [blacks]; American Indians and Alaska Natives [American Indians/Alaska Natives]; Asians; Native Hawaiians or Pacific Islanders [Native Hawaiians/Pacific Islanders]; and Hispanics/Latinos [Hispanics]), these estimates can mask differences in cigarette smoking prevalence among subgroups of these populations. To assess the prevalence of and changes in cigarette smoking among persons aged ≥18 years in six racial/ethnic populations and 10 select subgroups in the United States,† CDC analyzed self-reported data collected during 2002–2005 and 2010–2013 from the National Survey on Drug Use and Health (NSDUH) (*2*) and compared differences between the two periods. During 2010–2013, the overall prevalence of cigarette smoking among the racial/ethnic populations and subgroups ranged from 38.9% for American Indians/Alaska Natives to 7.6% for both Chinese and Asian Indians. During 2010–2013, although cigarette smoking prevalence was relatively low among Asians overall (10.9%) compared with whites (24.9%), wide within-group differences in smoking prevalence existed among Asian subgroups, from 7.6% among both Chinese and Asian Indians to 20.0% among Koreans. Similarly, among Hispanics, the overall prevalence of current cigarette smoking was 19.9%; however, within Hispanic subgroups, prevalences ranged from 15.6% among Central/South Americans to 28.5% among Puerto Ricans. The overall prevalence of cigarette smoking was higher among men than among women during both 2002–2005 (30.0% men versus 23.9% women) and 2010–2013 (26.4% versus 21.1%) ($p<0.05$). These findings highlight the importance of disaggregating tobacco use estimates within broad racial/ethnic population categories to better understand and address disparities in tobacco use among U.S. adults.

NSDUH is an annual household survey that collects data on drug use, drug use disorders, and tobacco use, from a nationally

* http://www.cdc.gov/tobacco/data_statistics/sgr/2004/index.htm.

† The racial and ethnic populations and select subgroups include non-Hispanic whites; non-Hispanic blacks or African Americans; American Indians/Alaska Natives; Native Hawaiians/Other Pacific Islanders; Chinese; Filipino; Japanese; Asian Indian; Koreans; Vietnamese; Mexicans; Puerto Ricans; Central/South Americans; and Cubans.

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representative sample of the U.S. noninstitutionalized, civilian population aged ≥12 years. To obtain a sample size large enough to examine current cigarette smoking[§] within disaggregated racial/ethnic subgroups, multiple years of data were combined; estimates for adults aged ≥18 years were based on combined data from 2002–2005 (N = 180,833) and 2010–2013 (N = 183,623). The average, weighted, overall response rate for respondents aged ≥18 years was 69.0% for the 2002–2005 NSDUH surveys and 62.4% for the 2010–2013 surveys.

Race/ethnicity was determined based on respondents' self-reported classification. For race, respondents were asked, "Which of these groups best describes you?" Response selections were "white"; "black or African American"; "American Indian or Alaska Native"; "Native Hawaiian"; "other Pacific Islander"; "Asian"; and "other." Persons who indicated that they were Asian were also asked to select the specific subgroup (Chinese, Filipino, Japanese, Asian Indian, Korean, or Vietnamese) that best described them. Because of small sample size, the "Native Hawaiian" and "other Pacific Islanders" populations were combined.[¶] To identify Hispanic ethnicity, respondents were asked, "Are you of Hispanic, Latino, or Spanish origin or descent?" Those who answered affirmatively were also asked to select the specific Hispanic origin subgroup (Mexican, Puerto Rican, Central or South American, or Cuban) that best described them. In this report, whites and blacks refer to non-Hispanic whites and non-Hispanic blacks, respectively.

Data were weighted to yield national estimates[**]; 95% confidence intervals were calculated for all point estimates. Sex differences in current cigarette smoking within each racial/ethnic population during each time period and across years were assessed using a t-test, with p-values <0.05 defined as statistically significant.[††]

Seven racial/ethnic populations/subgroups (whites, blacks, American Indians/Alaska Natives, Native Hawaiians/Pacific Islanders, Koreans, Puerto Ricans, and Cubans) reported an overall cigarette smoking prevalence of ≥25% during 2002–2005; however, only two of these populations/subgroups (American Indians/Alaska Natives [38.9%] and Puerto Ricans [28.5%]) had cigarette smoking prevalences ≥25% during 2010–2013 (Table). Among six racial/ethnic populations/subgroups (whites, blacks, Native Hawaiians/ Pacific Islanders, Asian Indians, Mexicans, and Central/South Americans), a significant decline in prevalence of cigarette smoking from 2002–2005 to 2010–2013 was reported. No significant differences were observed among the other groups (American Indians/Alaska Natives, Chinese, Filipinos, Japanese, Koreans, Vietnamese, Puerto Ricans, and Cubans).

[§] Current cigarette smokers were persons who reported smoking part or all of a cigarette on at least one day within the past 30 days.

[¶] For this analysis, all Hispanics are included in the Hispanic group, regardless of race; all other race/ethnicity categories excluded Hispanics.

[**] Overall estimates included persons identifying as being of more than one of the listed races; however, these persons were excluded in the specific racial/ethnic subgroup analyses.

[††] Estimates with relative standard error >17.5% were excluded.

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TABLE. Past 30-day cigarette use among persons aged ≥18 years, by race/ethnicity and sex — National Survey on Drug Use and Health, United States, 2002–2005 and 2010–2013

Ethnicity/Race	Men		Women		Total	
	2002–2005 (n = 84,429) % (95% CI)	2010–2013 (n = 86,226) % (95% CI)	2002–2005 (n = 96,404) % (95% CI)	2010–2013 (n = 97,397) % (95% CI)	2002–2005 (N = 180,833) % (95% CI)	2010–2013 (N = 183,623) % (95% CI)
Not Hispanic/Latino*	30.0†,§ (29.5–30.5)	26.7§ (26.2–27.2)	24.8† (24.3–25.3)	22.2 (21.7–22.7)	**27.3† (26.9–27.7)**	**24.3 (24.0–24.7)**
White	29.7†,§ (29.1–30.3)	26.6§ (26.0–27.2)	25.9† (25.3–26.4)	23.3 (22.8–23.9)	**27.7† (27.3–28.2)**	**24.9 (24.5–25.3)**
Black/African American	33.6†,§ (32.0–35.3)	29.9§ (28.5–31.3)	22.8† (21.6–24.1)	20.9 (19.6–22.1)	**27.6† (26.6–28.7)**	**24.9 (24.0–25.9)**
American Indian/ Alaska Native	39.3 (32.9–46.1)	40.8 (34.4–47.4)	35.2 (30.0–40.8)	37.3 (32.2–42.7)	**37.1 (32.9–41.4)**	**38.9 (34.7–43.2)**
Native Hawaiian/ Other Pacific Islander	35.9 (26.8–46.0)	27.0 (19.2–36.5)	26.6 (20.0–34.5)	18.5 (13.0–25.7)	**31.4† (25.4–38.0)**	**22.8 (17.8–28.8)**
Asian*	21.6†,§ (19.2–24.2)	16.2§ (14.3–18.4)	8.1† (6.8–9.6)	6.2 (5.3–7.4)	**14.5† (13.1–16.0)**	**10.9 (9.8–12.0)**
Chinese	13.9§ (10.4–18.3)	13.1§ (9.1–18.5)	4.6 (2.8–7.4)	2.9 (1.8–4.7)	**8.8 (6.9–11.3)**	**7.6 (5.6–10.3)**
Filipino	25.5§ (19.5–32.5)	20.6§ (14.9–27.8)	10.2 (7.2–14.4)	7.5 (5.3–10.6)	**16.7 (13.7–20.2)**	**12.6 (9.8–16.0)**
Japanese	17.2§ (11.7–24.6)	—¶	8.0 (5.1–12.1)	5.9 (3.2–10.7)	**12.1 (9.2–15.8)**	**10.2 (6.0–16.7)**
Asian Indian	19.0†,§ (14.1–25.2)	11.6§ (9.3–14.3)	3.4 (2.3–5.2)	3.3 (1.9–5.6)	**11.8† (8.9–15.4)**	**7.6 (6.1–9.4)**
Korean	37.4†,§ (28.2–47.6)	19.3 (12.7–28.1)	20.1 (14.1–27.8)	20.4 (14.2–28.6)	**26.6 (21.3–32.7)**	**20.0 (15.2–25.8)**
Vietnamese	32.5§ (24.6–41.5)	24.4§ (16.8–34.0)	8.0 (4.4–14.0)	7.9 (4.2–14.2)	**21.5 (16.4–27.7)**	**16.3 (11.9–21.8)**
Hispanic*	30.1†,§ (28.6–31.6)	25.1§ (23.9–26.3)	17.5† (16.3–18.7)	14.7 (13.7–15.7)	**23.9† (23.0–24.9)**	**19.9 (19.1–20.7)**
Mexican	31.0†,§ (29.2–32.8)	25.1§ (23.7–26.6)	15.7† (14.4–17.2)	12.9 (11.8–14.0)	**23.8† (22.6–24.9)**	**19.1 (18.2–20.1)**
Puerto Rican	35.6§ (30.2–41.3)	32.1§ (27.9–36.6)	28.0 (23.9–32.5)	25.1 (21.3–29.3)	**31.5 (28.0–35.2)**	**28.5 (25.8–31.4)**
Central or South American	25.3†,§ (21.9–29.1)	19.8§ (16.6–23.4)	14.7 (11.9–18.0)	11.4 (8.9–14.4)	**20.2† (18.0–22.6)**	**15.6 (13.5–18.0)**
Cuban	29.3 (23.3–36.0)	24.1§ (19.0–30.2)	21.5 (15.6–28.9)	15.1 (11.6–19.4)	**25.2 (21.0–30.0)**	**19.8 (16.5–23.6)**

Abbreviation: CI = confidence interval.
* Totals include data on respondents who reported being of racial or ethnic subgroups not shown and on respondents who reported being of more than one racial or ethnic group.
† Difference between estimates for 2002–2005 and 2010–2013 is statistically significant (p≤0.05).
§ Difference between estimates for men and women in the same racial/ethnic group is statistically significant (p≤0.05).
¶ Low precision (relative standard error >17.5%); no estimate reported.

Smoking prevalence among Asians overall during 2010–2013 was 10.9%. Within-group differences in smoking prevalence existed among Asian subgroups, ranging from 7.6% among Chinese and Asian Indians to 20.0% among Koreans (Figure 1). Significant differences in smoking prevalence between men and women in the following four Asian subgroups were noted: Chinese (13.1% men versus 2.9% women), Filipino (20.6% versus 7.5%), Asian Indian (11.6% versus 3.3%), and Vietnamese (24.4% versus 7.9%). Smoking prevalence was similar among Korean men (19.3%) and women (20.4%).[§§] Similarly, among Hispanics, the overall prevalence of current cigarette smoking was 19.9%; however, within Hispanic subgroups, prevalence ranged from 15.6% among Central/South Americans to 28.5% among Puerto Ricans (Figure 2). Differences between men and women were significant for all Hispanic subgroups: Mexicans (25.1% men versus 12.9% women), Puerto Ricans (32.1% versus 25.1%), Central or South Americans (19.8% versus 11.4%), and Cubans (24.1% versus 15.1%) (p<0.05).

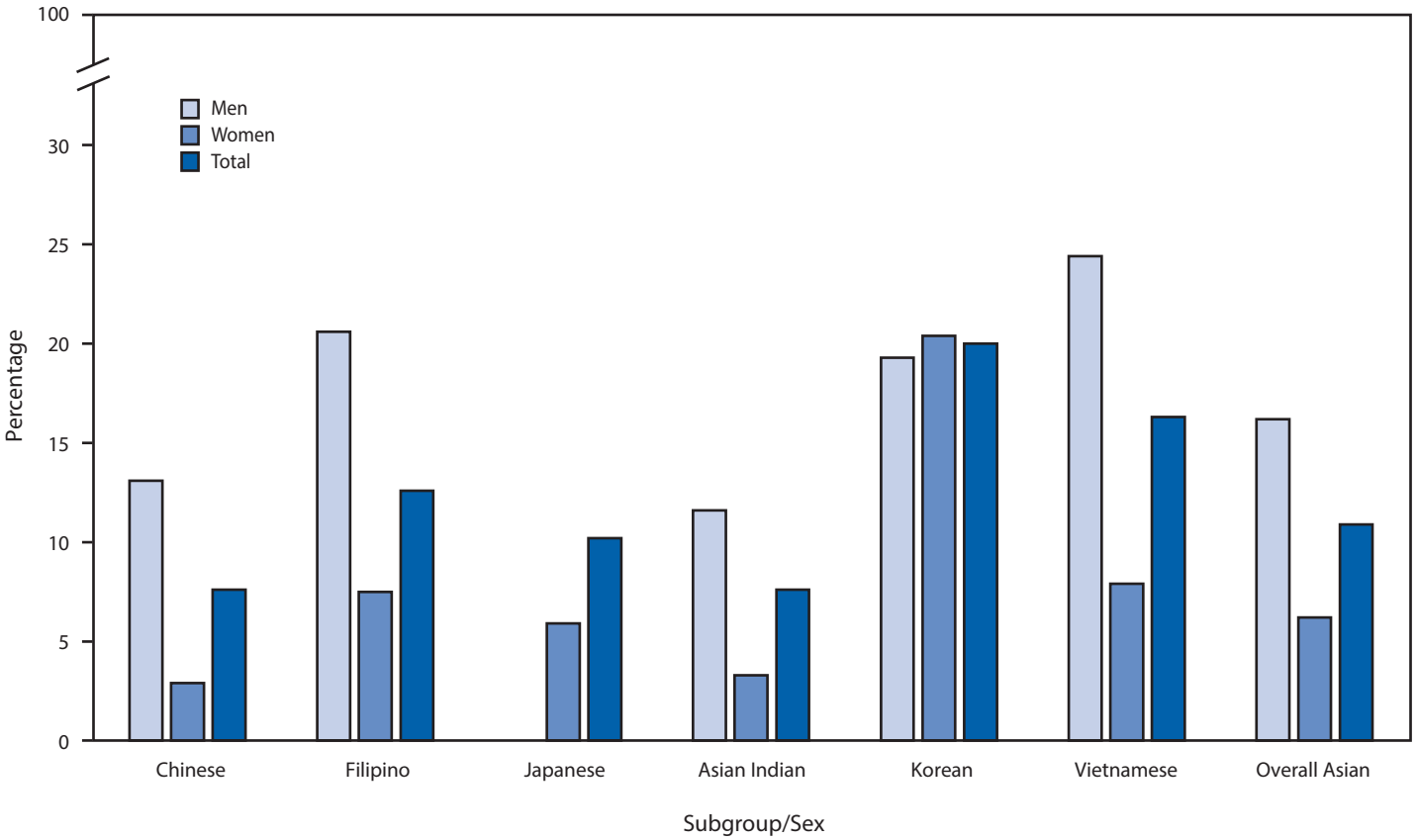
Among men, six populations/subgroups (whites, blacks, Asian Indians, Koreans, Mexicans, and Central/South Americans) reported a significantly lower prevalence of cigarette smoking during 2010–2013 than during 2002–2005; no significant changes were observed for men in other groups. Among women, a significant decline in cigarette smoking from the period 2002–2005 to the period 2010–2013 occurred in three populations/subgroups (whites, blacks, and Mexicans), with no significant changes among women in other ethnic groups. The overall prevalence of cigarette smoking was higher among men than among women during both 2002–2005 (30.0% men versus 23.9% women) and 2010–2013 (26.4% versus 21.1%) (p<0.05). During 2010–2013, among 10 racial/ethnic populations/subgroups (white, black, Chinese, Filipino, Japanese, Asian Indian, Vietnamese, Mexican, Puerto Rican, and Central/South American) men reported statistically higher cigarette smoking prevalence than did women. No significant sex differences in cigarette smoking prevalence was reported among American Indians/Alaska Natives (40.8% men and 37.3% women), Native Hawaiians/Pacific Islanders (27.0% men and 18.5% women), and Koreans (19.3% men and 20.4% women).

Discussion

Although substantial progress has been made in reducing overall cigarette smoking prevalence among U.S. adults (*3*,*4*), disparities exist among racial/ethnic populations, including

[§§] No estimate is reported for Japanese men because of low precision of data (relative standard error >17.5%).

FIGURE 1. Past 30-day cigarette use among persons aged ≥18 years, by Asian subgroup*,† and sex§ — National Survey on Drug Use and Health, United States, 2010–2013



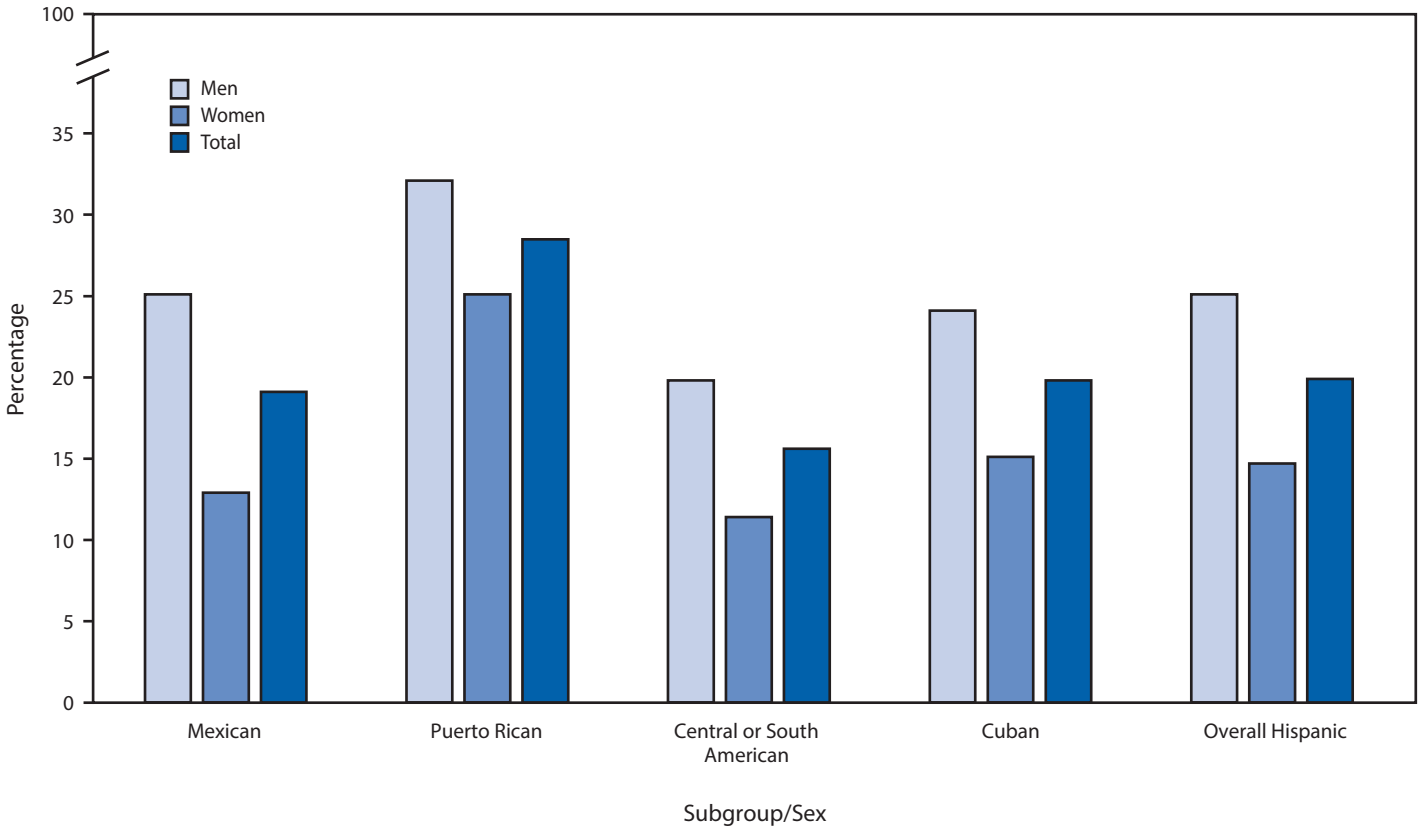
* Totals include data on respondents who reported being of racial or ethnic subgroups not shown and on respondents who reported being of more than one racial or ethnic group.
† No estimate reported for Japanese men because of low precision of data (relative standard error >17.5%).
§ Differences between estimates for men and women in the same racial/ethnic subgroup was statistically significant at the 0.05 level for the following subgroups: Chinese, Filipino, Asian Indian, Vietnamese, and Overall Asian.

disproportionately higher smoking prevalence in some racial/ethnic populations, and wide within-group variations. The highest prevalence of cigarette smoking was observed among American Indians/Alaska Natives, for whom no decline was observed during the assessed period; in addition, no significant changes were observed among Chinese, Filipino, Japanese, Korean, Vietnamese, Puerto Rican, and Cuban adults.

National estimates of cigarette smoking prevalence among U.S. racial/ethnic populations are often reported as aggregate estimates, which can obscure within-group disparities. For example, the findings in this report indicate substantial disparities in adult cigarette smoking among and within Asian and Hispanic populations, with Koreans and Puerto Ricans reporting the highest cigarette smoking prevalences within their respective racial/ethnic populations. These differences might be caused, in part, by variations in socioeconomic status, acculturation, targeted advertising, price of tobacco products, and practices related to the acceptability of tobacco use across population groups (*1*). In addition, these findings indicate disproportionately higher smoking prevalences among men compared with women within racial/ethnic groups. These differences underscore the importance of implementation of evidence-based strategies to reduce tobacco use among all population groups, particularly those with the highest prevalence (*1*).

The findings in this report are subject to at least five limitations. First, respondents were able to complete the interview only in English or Spanish, which might have resulted in misreporting or nonresponse among persons who do not speak either language. Second, cigarette use was self-reported and might have been subject to misreporting; however, studies have found that self-reported cigarette smoking correlates highly with biochemical tests such as serum cotinine, irrespective of race/ethnicity (*5*). Third, because NSDUH does not include institutionalized populations and persons in the military, results

FIGURE 2. Past 30-day cigarette use among persons aged ≥18 years, by Hispanic subgroup* and sex† — National Survey on Drug Use and Health, United States, 2010–2013



* Totals include data on respondents who reported being of racial or ethnic subgroups not shown and on respondents who reported being of more than one racial or ethnic group.
† Differences between estimates for men and women in the same racial/ethnic subgroup was statistically significant at the 0.05 level for all subgroups, including Overall Hispanic.

might not be generalizable to these groups. Fourth, the results from this study did not report variations in cigarette smoking prevalence among all racial/ethnic populations because the U.S. Census does not identify subgroups for whites, blacks and American Indians/Alaska Natives. However, regional differences in cigarette smoking prevalence among American Indians/Alaska Natives exist. For example, cigarette smoking is higher among American Indians living in the Northern Plains region, as well as among Alaska Natives living in Alaska compared with American Indians living in the Southwest (*6*). Finally, these estimates might differ from results from other surveillance systems. For example, cigarette smoking prevalence estimates from the National Health Interview Survey tend to be consistently lower each year than those estimated by the NSDUH (*7*). Differences in prevalence between the National Health Interview Survey and NSDUH can be partially explained by differing survey methodologies, types of surveys administered, and definitions of current smoking; however, trends in prevalence are comparable across surveys.

Reducing the overall prevalence of cigarette smoking among U.S. adults to the Healthy People 2020 target of ≤12%¶¶ can be achieved through the implementation and enforcement of evidence-based tobacco control initiatives. Proven interventions, including increasing the price of tobacco products coupled with evidence-based cessation services, comprehensive smoke-free policies, media campaigns, and promotion of cessation treatment in clinical settings, are effective in reducing tobacco use and tobacco-related disease and death in all racial/ethnic populations (*8*,*9*). If broadly implemented and enforced, these interventions could also reduce tobacco-related health disparities (*8*–*10*). In addition, opportunities exist to involve members of racial/ethnic communities in expanded tobacco control activities for specific populations, such as conducting linguistically and culturally competent educational campaigns.

¶¶ Objective TU-1.1 (https://www.healthypeople.gov/2020/topics-objectives/topic/tobacco-use/objectives).

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Summary

What is already known about this topic?

Although cigarette smoking has substantially declined since 1964, disparities in tobacco use varies among racial/ethnic populations. Estimates of U.S. adult cigarette smoking prevalence and tobacco use are usually limited to aggregate racial/ethnic population categories.

What is added by this report?

From the period 2002–2005 to the period 2010–2013, declines in cigarette smoking occurred among some racial/ethnic populations. Moreover, the relative change in smoking even among groups that did experience a decline varied across racial/ethnic populations. Substantial disparities in adult cigarette smoking prevalence exist among and within Asian and Hispanic subgroups, with Koreans and Puerto Ricans reporting the highest cigarette smoking prevalences within their respective racial/ethnic population. These findings indicate disproportionately higher smoking prevalence among men compared with women within most racial/ethnic groups.

What are the implications for public health practice?

Disparities in smoking prevalence exist among racial/ethnic populations, and several racial/ethnic populations have disproportionately higher prevalences of smoking and wide within-group variations. Proven interventions, including increasing the price of tobacco products coupled with evidence-based cessation services, comprehensive smoke-free policies, media campaigns, and promotion of cessation treatment in clinical settings, are effective strategies in reducing the overall prevalence of tobacco use and tobacco-related disease and death.

CDC Grand Rounds: Adolescence — Preparing for Lifelong Health and Wellness

Stephen Banspach, PhD[1]; Stephanie Zaza, MD[1]; Patricia Dittus, PhD[2]; Shannon Michael, PhD[3]; Claire D. Brindis, DrPH[4]; Phoebe Thorpe, MD[5]

Approximately 42 million adolescents aged 10–19 years, representing 13% of the population, resided in the United States in 2014 (*1*). Adolescence is characterized by rapid and profound physical, intellectual, emotional, and psychological changes (*2*), as well as development of healthy or risky behaviors that can last a lifetime. Parents have strong influence on their adolescent children's lives, and family-based programs can help parents support healthy adolescent development. Because schools are natural learning environments, implementing and improving school-based policies and programs are strategic ways to reinforce healthy behaviors and educate adolescents about reducing risky behaviors. Health care during adolescence should be tailored to meet the changing developmental needs of the adolescent while providing welcoming, safe, and confidential care. Parents, educators, care providers, public health officials, and communities should collaborate in fostering healthy environments for all adolescents, now and into the future.

Although adolescence is usually a relatively healthy life stage, preventable causes of death, illness, and injury do occur. Unintentional injuries (*3*), followed by suicide and homicide, are the top three causes of death among adolescents (Figure). Injuries are also the leading cause of nonfatal morbidity among adolescents (Table). During 2013, approximately 4 million unintentional nonfatal injuries resulted from being struck by something, falling, overexertion, car crashes, and other mechanisms. In addition, approximately 260,000 youths were treated in emergency departments for nonfatal physical assault injuries (excluding sexual assault), and 8% of high school students attempted suicide. Birthrates continue to decrease among teens, but during 2013, approximately 273,000 births to mothers aged 15–19 years occurred (*4*). Chlamydia and gonorrhea are prevalent among both males and females aged 15–19 years, and 25% of all reported chlamydia and gonorrhea infections occur in this age group (*5*).

Health outcomes often are driven by health risk behaviors established during adolescence. Preventing initiation of potentially harmful behaviors (e.g., smoking and binge drinking) and encouraging healthy eating and physical activity during adolescence can have lifelong health benefits. During 2013, 88% of students in grades 9–12 rarely or never used bicycle helmets; 41% texted or sent e-mails while driving a car; and a quarter were involved in physical fights (*6*). Sedentary behavior continues to be a challenge among adolescents, with only 27% getting the recommended 60 minutes of daily physical activity (*6*). Television-watching and other types of screen time are common, with 41% of students using computers and other devices for nonschool–work. In addition, recommendations for healthy eating (e.g., eating fruits and vegetables) are infrequently followed (*7*). Risk behaviors also contribute to negative reproductive health outcomes. Approximately half of high school students are sexually active, but few use the most effective contraceptives. Approximately 41% do not use condoms, leaving substantial numbers of teens unprotected against pregnancy and sexually transmitted diseases. Finally, substance use, which is prevalent among adolescents, contributes to both short- and long-term health risks. One third of high school students currently use alcohol, 23% use marijuana, and 22% use all forms of tobacco combined (*6*).

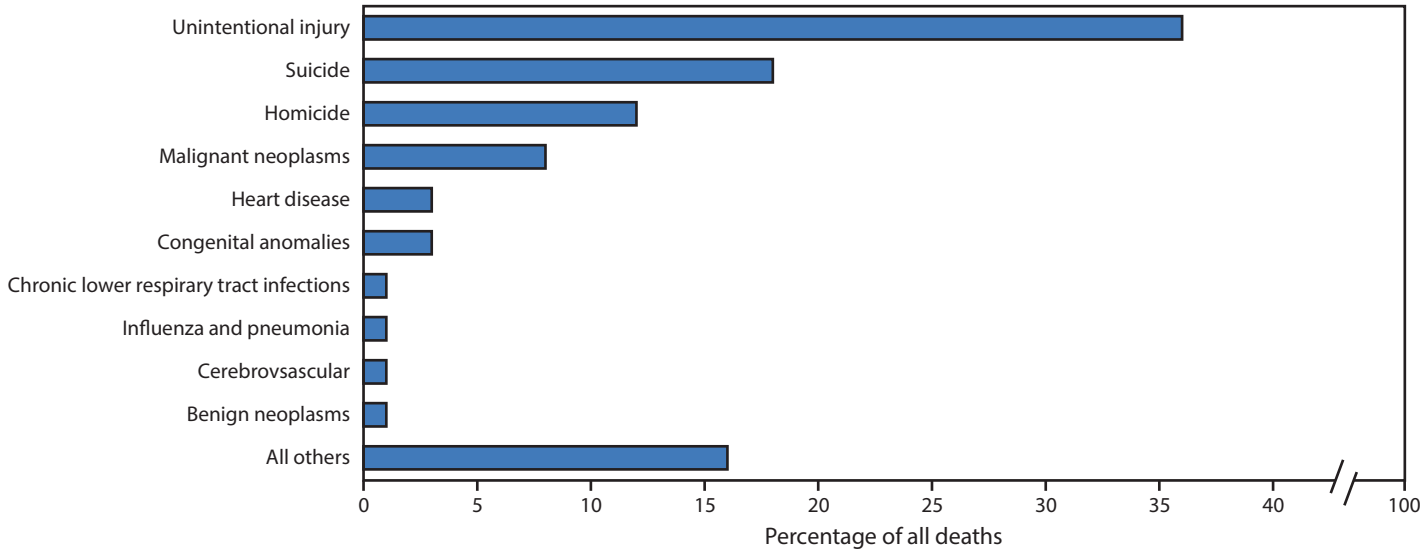
Public health's role in understanding and addressing adolescent health should provide adolescents with effective, accurate, and developmentally appropriate health promotion and disease prevention education and comprehensive health services. Such efforts require strategies and approaches that engage adolescents in the settings where they live, learn, and receive health care.

Family-Based Approaches

Family-based approaches aim to maximize the positive influence that parenting behaviors have on children by building parents' knowledge, skills, and confidence in communicating about risk, providing adequate monitoring and supervision, modeling positive behaviors, and building strong, trusting relationships with their children. Research has demonstrated that family-based interventions can reduce risk behaviors and improve health outcomes across multiple areas, including sexual initiation, delinquent behavior, and alcohol, tobacco, and drug use (*8*). Important components of effective family-based interventions include parenting skill-building activities with opportunities for improvement through practice (e.g., with other parents in a workshop or with their adolescent child

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

FIGURE. Proportional distribution of leading causes of death* among adolescents aged 10–19 years — United States, 2014



Source: CDC. Web-based Inquiry Statistics Query and Reporting System (WISQARS). http://webappa.cdc.gov/sasweb/ncipc/leadcaus10_us.html.
* Unintentional injuries include motor vehicle/traffic (2,834; 63%), poisoning (589; 13%), drowning (350; 8%), and other (713; 16%).

TABLE. Nonfatal health outcomes among adolescents aged 10–19 years — United States, 2013–2014*

Indicator	Age group or grade range	Estimate (no. or %)
Unintentional injuries†	10–19 yrs	4,373,717
Physical assault injuries†	10–19 yrs	260,949
Suicide attempt§	9th–12th grade	8%
Teen pregnancy¶	15–19 yrs	273,000
Chlamydia**	15–19 yrs	381,717
Gonorrhea**	15–19 yrs	68,468
Asthma††	0–17 yrs	9%
Obese (BMI ≥95th%)§§	12–19 yrs	21%

Abbreviation: BMI = body mass index.
* Nonfatal outcome data for 2013 includes injuries, suicide, and pregnancy. Nonfatal outcome data for 2014 includes sexually transmitted infections, asthma, and obesity.
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†† CDC. National Health Interview Survey U.S. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2014 https://www.cdc.gov/asthma/nhis/2014/table4-1.html.
§§ CDC. National Health and Nutrition Examination Survey, 2013–2014. Atlanta, GA: U.S. Department of Health and Human Services, CDC; [undated]. http://wwwn.cdc.gov/nchs/nhanes/search/nhanes13_14.aspx.

through joint homework assignments) and follow-up during brief sessions or telephone calls. During the follow-up interactions, parents are provided opportunities for feedback on attempted changes and additional information and guidance.

Despite the availability of these interventions, parents often face challenges participating in family-based programs because of busy schedules and competing demands, which can result in an inability to attend by those parents who could most benefit from the programs. Successful programs are those that include flexible scheduling and additional support through meals, transportation, and child care, all of which increase the likelihood that busy parents will attend. Alternate settings for workshops (e.g., workplaces or clinics) can help facilitate parents' participation (*9*,*10*). To date, few family-based interventions are brief programs that can reach large numbers of participants while demonstrating impact on adolescent behaviors. Programs that can overcome these barriers warrant further development and evaluation.

School-Based Approaches

Approximately 37,000 U.S. middle and high schools serve 38 million adolescents. Schools can provide opportunities for adolescents to learn about and practice healthy behaviors that can improve their health now and lead to continued healthy outcomes and success in the future. Healthy students are better learners (*11*) and have higher academic achievement and high school graduation rates, which translate to lifelong health benefits (*12*), underscoring the shared interest in promoting adolescent health among education

and health leaders. Schools can serve as principal venues for health education, health promotion, and disease prevention in ways that are supported by research. Schools are ideal places for conducting standards-based health education that sets expectations for what students should know and be able to do by grades 2, 5, 8, and 12 to promote personal, family, and community health (*13*); providing quality physical education and promoting physical activity and nutrition throughout the school environment (*14*,*15*); implementing comprehensive risk reduction interventions (*16*); providing cost-effective access to school-based health services (*17*); and implementing school policies and programs designed to create environments that are safe, positive, and supportive of healthy behaviors (*18*,*19*). To accomplish these goals, schools need a holistic approach to addressing students' health and learning. This includes having a coordinated approach that includes developing, implementing, and evaluating school policies and practices; creating supportive and safe school environments; improving the school nutrition environment and nutrition services; having comprehensive school physical activity programs with physical education as the foundation; implementing quality health education; serving students' physical and mental health and social service needs; partnering with families and the community; and promoting schoolwide healthy environments through school personnel wellness programs and health-related professional development opportunities for school employees (*15*).

Schools are places designed for learning, including learning about health. However, schools often face challenges in being the location for health promotion and disease prevention activities. Provision of health and physical education is often constrained by limitations in scheduling or the availability of qualified teachers. Traditional school practices regarding foods available in vending machines or other sources (e.g., à la carte) might conflict with recommendations for healthy eating. Health services are frequently limited by insufficient resources for school nursing and health care programs. CDC has developed a tool, the School Health Index (http://www.cdc.gov/HealthyYouth/SHI/), to assist educators and parents to improve school health programs. The index helps school health committees assess strengths and weaknesses across different health topics (e.g., physical education and physical activity, nutrition, tobacco use prevention, asthma care, unintentional injury and violence prevention, and sexual health), and take steps to improve school health policies and programs.

Health Services

Adolescence is a time when youths become increasingly responsible for their own health care as part of their growing independence and transition into adulthood. Because adolescent health problems are largely preventable, primary care visits offer an opportunity to provide evidence-based effective services (e.g., education, preventive screenings, and treatment) (*20*). Annual preventive care visits have been recommended for adolescents since the 1990s, although data indicate that fewer than half of adolescents have an annual well-care visit, with noted disparities attributable to insurance coverage, income, race/ethnicity, and sex (*21*). Overall, during 2011, 43% of adolescents had a preventive health visit. However, only 38% of adolescents living at or below the federal poverty level were likely to receive such services, and only a quarter of adolescents who lacked health insurance received a preventive visit. Important racial/ethnic disparities also existed, with only 37% of Hispanics receiving preventive health visits, whereas 43% of non-Hispanic blacks and 45% of non-Hispanic whites had received these visits (*21*). School-based health centers can provide an important avenue for reducing these disparities. School-based health centers in low-income communities have been demonstrated to improve both educational and health outcomes (*22*). Improved educational outcomes include school performance, grade promotion, and high school completion. Improved health outcomes include increased delivery of vaccinations and other recommended preventive services, increased contraceptive use among females, increased prenatal care, decreased asthma morbidity, and fewer emergency department visits and hospital admissions.

Regardless of where services are provided, opportunities for improving access to and use of clinical preventive services for adolescents include new coverage options provided by the Affordable Care Act (*23*,*24*) and ensuring that health care services are youth-friendly and developmentally appropriate. Principles that should guide adolescent health services include ensuring 1) availability of quality programs and services; 2) availability of programs and services developmentally tailored to the needs of early, middle, and late adolescence; 3) accessibility (e.g., transportation and ease of use); 4) welcoming environments for adolescents; and 5) an atmosphere where adolescents' opinions and experiences are valued.

Two challenges to providing health services for adolescents are maintaining confidentiality of services (i.e., keeping private patients' personal health information that is disclosed to their health care provider) and understanding minor consent laws (i.e., laws that enable minors to give consent for certain health care services). Providers have limits on how and when patient information can be shared with others. Traditionally, they are able to share health information only under limited circumstances, particularly if the young person poses a risk to himself or herself or others. Concern also exists in situations where an explanation of benefits might be sent from an insurer to the primary policyholder, revealing the sensitive nature of a medical care visit (*25*). Minor consent laws vary considerably

among states with regard to whether adolescents are able to give consent for selected sensitive health care services, including screening and treatment for sexually transmitted infections, mental health counseling, substance use services, and reproductive health services. Addressing these challenges to confidentiality and clarifying and communicating information about minor consent laws to adolescents, parents, schools, and health care providers are required to ensure that these barriers to adolescent health care are eliminated.

Conclusion

Adolescence is a period of intense growth and development. Supporting adolescents' health requires parents, schools, health care systems, and communities to help youths to be healthy throughout adolescence, develop healthy behaviors for a lifetime, and learn how to access and use the health care system. Parents, educators, and health care providers share the ultimate goal of helping adolescents achieve healthy, successful futures.

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Update on Vaccine-Derived Polioviruses — Worldwide, January 2015–May 2016

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In 1988, the World Health Assembly resolved to eradicate poliomyelitis worldwide (*1*). One of the main tools used in polio eradication efforts has been the live, attenuated, oral poliovirus vaccine (OPV) (*2*), an inexpensive vaccine easily administered by trained volunteers. OPV might require several doses to induce immunity, but provides long-term protection against paralytic disease. Through effective use of OPV, the Global Polio Eradication Initiative (GPEI) has brought wild polioviruses to the threshold of eradication (*1*). However, OPV use, particularly in areas with low routine vaccination coverage, is associated with the emergence of genetically divergent vaccine-derived polioviruses (VDPVs) whose genetic drift from the parental OPV strains indicates prolonged replication or circulation (*3*). VDPVs can emerge among immunologically normal vaccine recipients and their contacts as well as among persons with primary immunodeficiencies (PIDs). Immunodeficiency-associated VDPVs (iVDPVs) can replicate for years in some persons with PIDs. In addition, circulating vaccine-derived polioviruses (cVDPVs) (*3*) can emerge in areas with low OPV coverage and can cause outbreaks of paralytic polio. This report updates previous summaries regarding VDPVs (*4*).

During January 2015–May 2016, five new cVDPV outbreaks were identified in Burma (Myanmar) (two cases), Guinea (seven cases), Laos (11 cases), Madagascar (10 cases), and Ukraine (two cases) (*5*), while cVDPV type 2 (cVDPV2) circulation in Nigeria and Pakistan decreased sharply. Twenty-one newly identified persons in 10 countries were found to excrete iVDPVs, and a patient in the United Kingdom was still excreting an iVDPV in 2015 after >29 years of chronic infection. Ambiguous VDPVs (aVDPVs), isolates that cannot be classified definitively, were found among immunocompetent persons and environmental samples in 19 countries.

Global eradication of wild poliovirus type 2 was declared in September 2015, and wild poliovirus type 3 has not been detected since 2012. Currently, wild poliovirus type 1 transmission has been identified only in Afghanistan and Pakistan. Because the majority of VDPV isolates that have emerged from OPV use in recent years are type 2, the World Health Organization coordinated the worldwide replacement of trivalent OPV (tOPV; Sabin types 1, 2, and 3) with bivalent OPV (bOPV; types 1 and 3) in April 2016, preceded by introduction of at least 1 dose of injectable inactivated poliovirus vaccine (IPV) into routine immunization schedules in countries with higher risk for VDPV2 emergence and spread (*6*).

Properties of VDPVs

VDPVs are polioviruses whose genetic divergence from the parental OPV strains indicates prolonged replication or circulation (*3*). Three poliovirus serotypes (PV1, PV2, and PV3) have been identified. Poliovirus isolates are grouped into three categories: wild polioviruses (WPVs), vaccine-related polioviruses (VRPVs), and vaccine-derived polioviruses (VDPV). WPVs are capable of sustained person-to-person transmission without genetic evidence of vaccine strain origin. VRPVs have limited divergence (<1% divergent [PV1 and PV3] or <0.6% divergent [PV2]) in the VP1 nucleotide sequences from the corresponding OPV strain. VDPVs are >1% divergent (for PV1 and PV3) or >0.6% divergent (for PV2) in VP1 sequences from the corresponding OPV strain (*3*). VDPVs are further classified as 1) cVDPVs, when evidence of person-to-person transmission in the community exists; 2) iVDPVs, when they are isolated from persons with PIDs; and 3) aVDPVs, when they are clinical isolates from persons with no known immunodeficiency and no evidence of transmission, or they are sewage isolates that are unrelated to other known VDPVs and whose source is unknown (*3*).

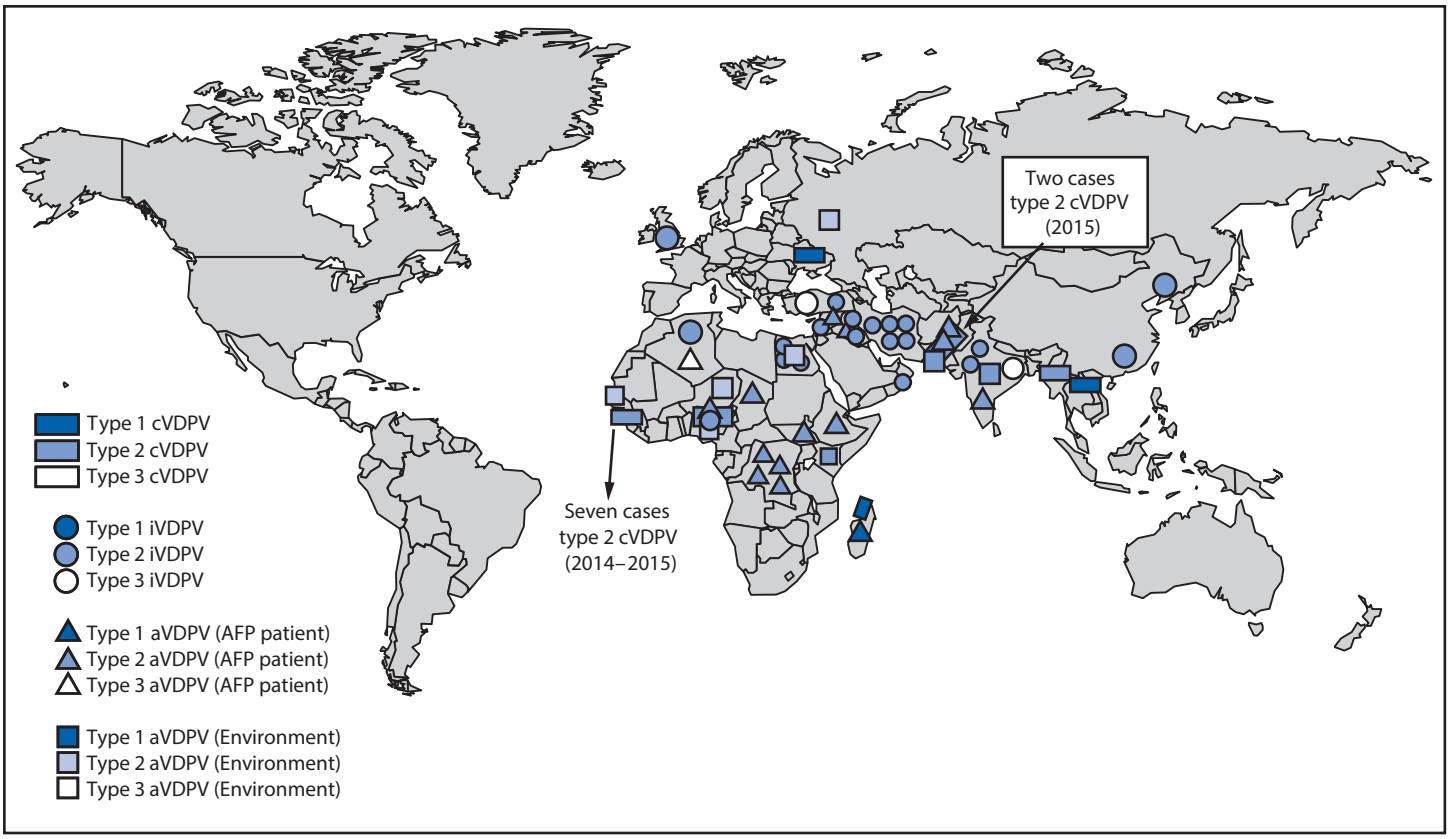
Virologic Testing for VDPVs

All poliovirus isolates are characterized by laboratories of the Global Polio Laboratory Network (*4*). VDPV screening is conducted using real-time reverse transcription–polymerase chain reaction (rRT-PCR) nucleic acid amplification, targeted to nucleotide substitutions that frequently revert to the parental WPV sequence during replication of OPV in the human intestine (*7*). Potential VDPVs identified by rRT-PCR screening are sequenced in the VP1 region for definitive analysis; the complete genome is sequenced if required for higher-resolution analysis.

Detection of cVDPVs

During January 2015–May 2016, the number of countries with detected cVDPV circulation increased from four to seven (Figure 1) (*4*). Outbreaks in South Sudan (cVDPV2) and Afghanistan (cVDPV2) appear to have been interrupted. Outbreaks of cVDPV2 in Pakistan and Nigeria have declined to very low incidence levels (*4*,*8*). New outbreaks were reported in Ukraine (cVDPV type 1 [cVDPV1], two cases), Burma (cVDPV2, two cases), Guinea (cVDPV2, seven cases), Laos (cVDPV1, 11 cases), and Madagascar (cVDPV1,

FIGURE 1. Vaccine-derived polioviruses (VDPVs) detected worldwide, January 2015–May 2016*



Abbreviations: cVDPV = circulating VDPV; iVDPV = immunodeficiency-associated VDPV; aVDPV = ambiguous VDPV; AFP = acute flaccid paralysis.
* Spread of cVDPVs followed the elimination of the corresponding serotype of indigenous wild poliovirus, but with continued introduction of oral poliovirus vaccine into communities with growing immunity gaps. All of the cVDPV outbreaks were detected first by the laboratory, using sequence data and evolutionary analyses.

10 cases) (Table). Among the 721 cVDPV cases detected worldwide during January 2006–May 2016, 681 (94%) were associated with cVDPV2, and 31 (4%) were associated with cVDPV1; however, during January 2015–May 2016, among 35 cVDPV cases, 23 (66%) were cVDPV1 (Table) (Figure 2).

Guinea. During 2015, seven cVDPV2s were isolated from patients aged <15 years with acute flaccid paralysis (AFP) in Kankan Province (up to 3% VP1 divergence). The first detected cVDPV2 associated with this outbreak was isolated from a patient in the same province with an August 2014 paralysis onset date.

Laos. Eight cVDPV1 cases in 2015 and three cases in 2016 were detected in three adjacent provinces (2.3%–3.9% VP1 divergence). The most recent case was reported in Fuang District of Vientiane Province, with paralysis onset in January 2016.

Madagascar. A cVDPV1 outbreak was initially detected in September 2014 in Analalava, Mahjanga Province, on the northwest coast; the virus circulated widely throughout the country during 2015. Genetically linked viruses were isolated in 2015; 10 AFP cases and 11 isolates were identified through community-based surveillance, with VP1 nucleotide sequence divergence up to 3.3% from the parental OPV strain.

Burma (Myanmar). During April and October 2015, two related cVDPV2s (1.4%–1.7% VP1 divergence) were detected from two AFP cases in the same province; the most recent isolate was from an AFP case in Rakhine province with onset date October 5, 2015.

Nigeria. Low-level circulation in northern states continued during January 2015–May 2016 (*4*). Virus from the major cVDPV2 lineage group that first emerged in 2005 (*8*) was isolated from a sewage sample collected on March 4, 2015 (7.3% VP1 divergence). Virus from an independent cVDPV2 emergence (3.5% VP1 divergence from Sabin 2 and 2.2% divergence from its nearest relative), originating in Chad in 2012 (*9*), was isolated from sewage samples; the most recent positive sample was reported from Borno State on April 29, 2016 (*10*). In addition, one Kaduna State sewage isolate and an isolate from an AFP case were linked to the outbreak detected in 2014 (the most recent positive sample was reported on May 28, 2015 [1.4% VP1 divergence]) (*4*).

TABLE. Number of vaccine-derived polioviruses (VDPVs) detected, by classification and other selected characteristics — worldwide, January 2015–May 2016

Country	Year(s) detected*	Source†	Serotype	No. of isolates§ January 2015–May 2016			VP1 divergence from Sabin OPV strain (%)¶	Routine OPV3 coverage (%)**	Estimated duration of VDPV replication††	Current status (date of last outbreak case, patient isolate, or environmental sample)
				No. of cases	No. of contacts	No. of non-AFP sources				
Circulating VDPVs (cVDPVs)										
Guinea	2014–15	Outbreak	2	7	6	0	2.4–3.0	42	2.7 yrs	Dec 26, 2015
Laos	2015–16	Outbreak	1	11	25	0	2.3–3.9	88	3.5 yrs	Jan 11, 2016
Madagascar	2014–15	Outbreak	1	10	11	0	2.3–3.3	73	3 yrs	Sep 2, 2015
Burma (Myanmar)	2015	Outbreak	2	2	0	0	1.4–1.7	76	1.5 yrs	Oct 5, 2015
Nigeria	2005–15	Outbreak	2	0	0	1	7.3	72	6.6 yrs	Mar 4, 2015
Nigeria	2014–15	Outbreak	2	1	0	1	1.4	72	~1 yr	May 28, 2015
Nigeria	2013–16	Outbreak – importation	2	0	0	1	3.5	72	~3 yrs	Mar 23, 2016
Pakistan	2012–15	Outbreak	2	2	0	15	0.7–2.1	72	~2 yrs	Mar 28, 2015
Ukraine	2015	Outbreak	1	2	0	0	2.2–2.9	74	2.6 yrs	Jul 12, 2015
Immunodeficiency-associated VDPVs (iVDPVs)										
Algeria	2015	AFP patient	2	1	0	0	1.7	95	1.5 yrs	Jul 22, 2015
China	2015	AFP patient	2	1	0	0	0.8	99	<1 yr	Mar 12, 2015
China	2015	AFP patient	2	1	0	0	2.4	99	~2 yrs	Mar 19, 2015
Egypt	2015	AFP patient PID	2	1	0	0	1.9	94	1.7 yrs	Dec 9, 2015
Egypt	2016	Non-AFP PID	2	0	0	1	1.3	94	~1 yr	Apr 18, 2016
Egypt	2016	Non-AFP PID	2	0	0	1	2.0	94	<2 yrs	May 22, 2016
Nigeria	2015	AFP patient	2	1	0	0	0.7	72	<1 yr	Oct 9, 2015
India	2015	AFP patient CVID	2	1	0	0	2.7–4.0	82	2.3 yrs–4 yrs	Mar 8, 2016
India	2015	AFP patient XLA	2	1	0	0	0.7	82	7 mos	Feb 29, 2016
India	2015	Non-AFP SCID	3	0	0	1	4.5–10.2	82	3.9 yrs; 6 yrs	May 30, 2016
Iran	2015	AFP patient SCID	2	1	0	0	0.8–1.6	99	~1.5 yrs	Feb 7, 2016
Iran	2015	Non-AFP SCID 1	2	0	0	1	1.3–1.8	99	~1.5 yrs	Feb 16, 2016
Iran	2015	Non-AFP SCID 2	2	0	0	1	0.7	99	<1 yr	Oct 14, 2015
Iran	2015	Non-AFP SCID 3	2	0	0	1	1.1	99	1 yr	Oct 14, 2015
Iran	2015	Non-AFP SCID 4	2	0	0	1	1.8–2.2	99	2 yrs	Feb 8, 2016
Iraq	2015	AFP patient PID	2	1	2	0	1.9	76	1.7 yrs	Jul 23, 2015
Iraq	2016	AFP patient PID	2	1	0	0	0.8	76	<1 yr	Feb 13, 2016
Oman	2015	Non-AFP PID	2	0	0	1	0.8–1.6	99	~1.5 yrs	Nov 30, 2015
Turkey	2015	Non-AFP PID	3	0	0	1	1.7	96	1.5 yrs	Feb 22, 2015
Turkey	2015	AFP patient PID	2	1	0	0	0.7–0.8	96	<1 yr	Mar 20, 2015
UK	2015	Non-AFP PID	2	0	0	1	16.6–16.7	96	>29 yrs	Nov 17, 2015
West Bank and Gaza Strip	2015	Non-AFP SCID	2	0	0	1	1.0–1.9	96	1.7 yrs	May 3, 2016
Ambiguous VDPVs (aVDPVs)										
Algeria	2015	AFP patient	3	1	0	0	1.6	95	~1.5 yrs	May 5, 2015
Chad	2015	AFP patient	2	1	0	0	0.8	54	<1 yr	Jan 15, 2015
China	2015	Non-AFP	1	0	0	1	1.1	99	1 yr	Mar 20, 2015
Democratic Republic of the Congo	2015–16	AFP patient	2	4	0	0	0.7–1.8	79	1.5 yrs	Mar 29, 2016
Egypt	2015–16	Environmental sample	2	0	0	4	0.7–0.9	94	<1 yr	Mar 15, 2015
Ethiopia	2015	AFP patient	2	1	0	0	0.8	75	<1 yr	Mar 11, 2015
India	2015	AFP patient	2	1	0	0	0.8	82	<1 yr	Mar 8, 2015
India	2015	Environmental sample	2	0	0	15	0.7–1.4	82	7 mos–1.3 yrs	May 16, 2016
Iraq	2015	AFP patient	2	1	0	0	1.0–1.3	76	~1 yr	Nov 24, 2015
Kenya	2015	Environmental sample	2	0	0	1	0.8	81	<1 yr	Dec 30, 2015
Madagascar	2015	AFP patient	1	1	1	0	3.5–3.9	73	3.5 yrs	Feb 22, 2015
Netherlands	2015	Non-AFP	3	0	0	1	1.7	96	1.5 yrs	Jun 16, 2015
Niger	2015	Environmental sample	2	0	0	1	0.9	67	<1 yr	Dec 29, 2015

See table footnotes on next page.

TABLE. (*Continued*) Number of vaccine-derived polioviruses (VDPVs) detected, by classification and other selected characteristics — worldwide, January 2015–May 2016

Country	Year(s) detected*	Source†	Serotype	No. of isolates§ January 2015–May 2016			VP1 divergence from Sabin OPV strain (%)¶	Routine OPV3 coverage (%)**	Estimated duration of VDPV replication††	Current status (date of last outbreak case, patient isolate, or environmental sample)
				No. of cases	No. of contacts	No. of non-AFP sources				
Nigeria	2016	AFP patient	2	1	0	0	0.9	72	<1 yr	May 18, 2016
Nigeria	2015	Environmental sample	2	0	0	4§§	0.7–0.8	72	<1 yr	Mar 9, 2015
Pakistan	2015	AFP patient	2	2	0	0	1.0–1.2	72	~1 yr	Aug 20, 2015
Pakistan	2015	Environmental sample	2	0	0	8	0.7–1.0	72	~1 yr	Dec 12, 2015
Russia	2015	Environmental sample	2	0	0	1	17.6	97	>15 yrs	Sep 17, 2015
Republic of South Sudan	2015	AFP patient	2	1	0	0	1.6	44	~1.5 yrs	Apr 22, 2015
Senegal	2015	Environmental sample	2	0	0	1	0.7	85	<1 yr	Nov 5, 2015
Syria	2015	AFP patient	2	1	0	0	0.7	52	<1 yr	May 13, 2016
Turkey	2015	AFP contact	2	0	1	0	0.7	96	<1 yr	Jan 20, 2015

Abbreviations: AFP = acute flaccid paralysis; OPV = oral poliovirus vaccine; PID = primary immunodeficiency; SCID = severe combined immunodeficiency; XLA = X-linked agammaglobulinemia.

* Total years detected and cumulative totals for previously reported cVDPV outbreaks (Nigeria, Pakistan).

† Outbreaks list total cases clearly associated with cVDPVs. Some VDPV case isolates from outbreak periods might be listed as aVDPVs.

§ Total cases for VDPV-positive specimens from AFP cases and total VDPV-positive samples for environmental (sewage) samples.

¶ Percentage of divergence is estimated from the number of nucleotide differences in the VP1 region from the corresponding parental OPV strain.

** Coverage with 3 doses of oral poliovirus vaccine, based on 2014 data from the World Health Organization (WHO) Vaccine Preventable Diseases Monitoring System (2015 global summary) and WHO-UNICEF coverage estimates. National data might not reflect weaknesses at subnational levels. http://www.who.int/immunization/monitoring_surveillance/en/.

†† Duration of cVDPV circulation was estimated from extent of VP1 nucleotide divergence from the corresponding Sabin OPV strain; duration of immunodeficiency-associated VDPV replication was estimated from clinical record by assuming that exposure was from initial receipt of OPV; duration of ambiguous VDPV replication was estimated from sequence data.

§§ Three genetically linked isolates were classified as aVDPVs according to the VDPV guidelines (http://www.polioeradication.org/Portals/0/Document/Resources/VDPV_ReportingClassification.pdf), which require detection for >2 months.

Pakistan. Among the five independent cVDPV2 emergences reported previously (*4*), only one persisted during January 2015–May 2016, detected in 14 environmental samples collected in Sindh and one in Baluchistan. Two AFP cases reported in Federally Administered Tribal Areas and Khyber Pakhtunkhwa with onset in February 2015 were genetically linked to a new cVDPV2 emergence (0.7% divergent from parental Sabin 2). This new cVDPV2 emergence was not detected after February 2015. No cVDPVs have been detected in 2016.

Ukraine. In 2015, two genetically linked cVDPV1s (2.2%–2.9% VP1 divergence) were detected in southwestern Ukraine, from two AFP cases with onset dates of June 30 and July 7.

Detection of iVDPVs

After implementation of intensified surveillance for iVDPVs, detection of new iVDPV infections increased from eight in 2014 to 21 during January 2015–May 2016. (Table). During this reporting period, with the exception of two type 3 iVDPVs, all were type 2. Like cVDPVs, the cumulative serotype distribution since OPV introduction shows that type 2 iVDPVs are the most prevalent (66%), followed by type 1 (14%), type 3 (14%), and heterotypic mixtures (6%). Selected iVDPVs from the reporting period are described below.

Egypt. A male child aged 11 months with PID developed paralysis in December 2015; iVDPV2 was detected. In April 2016, an unrelated iVDPV2 was isolated from a nonparalyzed PID patient.

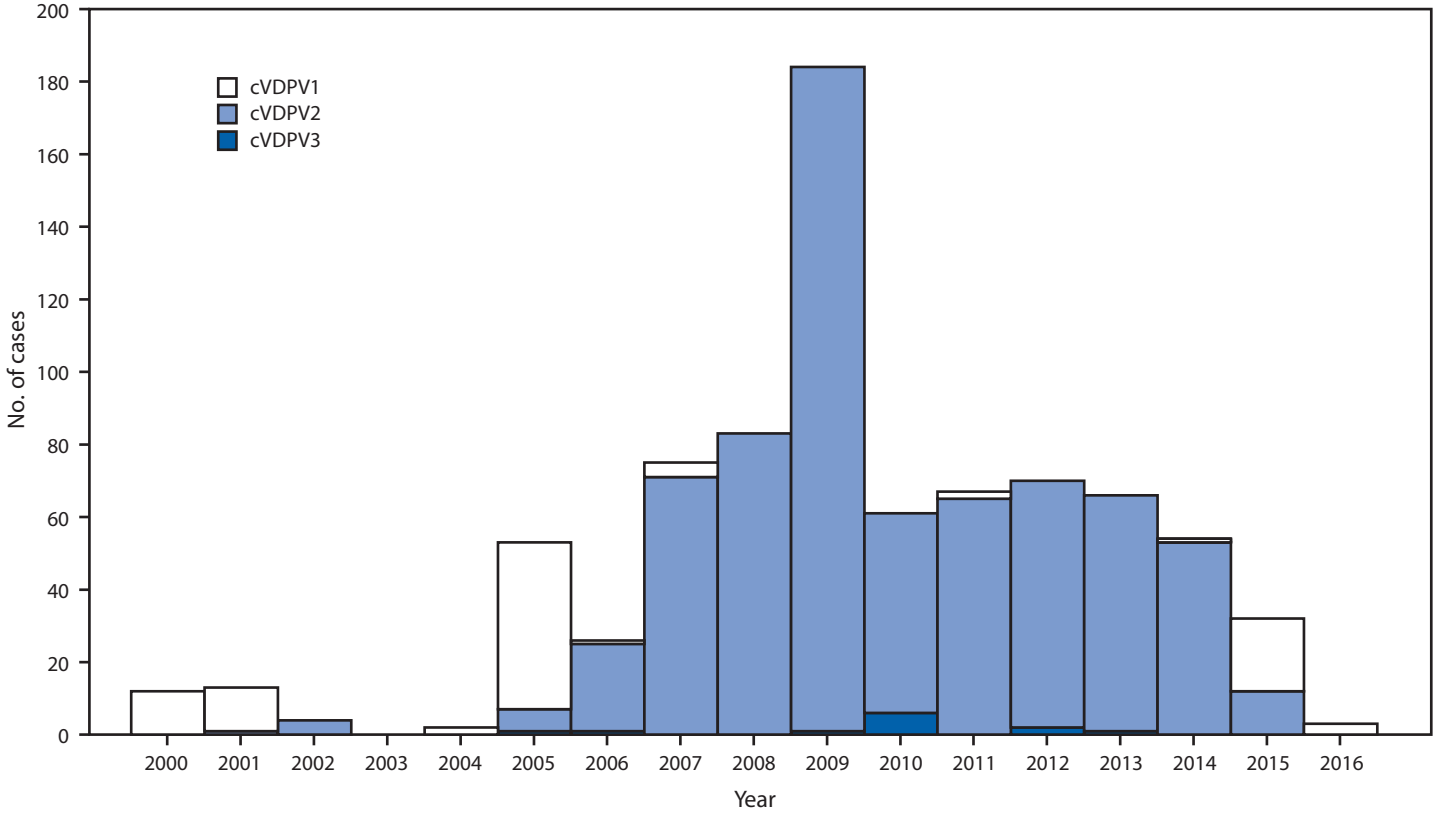
Iran. During this reporting period, five patients (one with AFP) were found to be excreting iVDPVs. A girl aged 6 months with severe combined immunodeficiency (SCID), who received OPV in March 2015, developed AFP in September 2015. The last positive sample from this child was in February 2016. Four nonparalytic SCID patients were found to be excreting type 2 iVDPVs; two of these patients (one each from Tehran and Ardebil provinces) died; the other two were from Golestan and Kermanshah provinces.

Iraq. A girl with PID developed AFP at age 8 months. In July 2015, iVDPV2 was detected, and the girl subsequently died.

Oman. A boy with major histocompatibility complex class II deficiency was found to be infected with iVDPV2 at age 9 months.

West Bank and Gaza. In October 2015, a girl aged 5 months with SCID who had not developed AFP was found to be infected with an iVDPV2. She remains hospitalized after bone marrow transplantation and continues to excrete iVDPV2.

FIGURE 2. Number of circulating vaccine-derived poliovirus (cVDPV) cases detected, by serotype — worldwide, January 2000–May 2016*



* Data through May 2016 as available by July 14, 2016.

Detection of aVDPVs

During January 2015–May 2016, aVDPVs were isolated in 19 countries (Table). The most divergent aVDPV (3.9% VP1 divergence) was isolated from an AFP case in Madagascar. This represented an emergence independent from a cVDPV emergence that circulated broadly in Madagascar during the same period. Report of aVDPVs in settings with immunization coverage <60% might indicate a risk for cVDPV emergence and further spread and potential gaps in surveillance. Selected aVDPVs from the reporting period are described below.

Chad. An aVDPV2 (0.8% VP1 divergence) was isolated from an AFP case with paralysis onset in January 2015 in Mayo-Kebbi Est Province.

Democratic Republic of the Congo. Four independent aVDPV2s were isolated from four AFP clinical samples: two in 2015 (0.8%–1.1% VP1 divergence) and two in 2016 (0.7%–1.7% VP1 divergence). The latest isolate from 2016 resembles an iVDPV2, but because no immunodeficient source patient has been identified, classification of this VDPV is pending.

Egypt. Four environmental samples contained aVDPVs (0.7–0.9% VP1 divergence), three in 2015 and one in 2016. They were collected from four distinct collection sites during February 2015–March 2016.

Kenya. An aVDPV2 (0.8% VP1 divergence) was isolated from a sewage specimen collected in Nairobi in December 2015. The virus had four amino acid differences from Sabin 2, all in the neutralizing antigenic sites, suggesting an iVDPV. However, no immunodeficient source patient has been identified.

Madagascar. An aVDPV1 (3.9% VP1 divergence) was isolated from a patient in Nosy-Varika, Fianarantsoa Province, on the central east coast, who had AFP onset on January 31, 2015. Despite a small number of VP1 substitutions shared with the 2014 cVDPV1 isolates from Analalava, on the northwest coast, the sequence properties of this aVDPV1 are consistent with an independent VDPV1 emergence. Thus, two emergences of VDPV were detected, but only one sustained circulation.

Netherlands. An aVDPV3 was isolated from a non-AFP case in a Syrian refugee who arrived in Netherlands in 2014. The date of the last positive specimen (1.7% VP1 divergence) was June 16, 2015.

Nigeria. Four aVDPV2s (all from sewage samples; all with 0.7%–0.8% VP1 divergence) were isolated in Sokoto State during the reporting period; the most recent sample was collected on March 9, 2015. Three of the isolates were genetically linked, although closely related (within 2 nucleotide differences), and detection was limited to two serial collections, on February 9

and March 9. An aVDPV2 was isolated from an AFP patient who developed paralysis on May 14, 2016, in Jigawa State.

Pakistan. Ten aVDPV2s (two from AFP patients and eight from sewage samples; 0.7%–1.2% VP1 divergence) were isolated in 2015. The most recent aVDPV2 isolates were from an AFP patient in Sindh province in August 2015 (1.0% VP1 divergence), and from a sewage sample collected in Baluchistan in December 2015 (0.7% VP1 divergence).

Discussion

The number of cVDPV outbreaks worldwide increased since the January 2014–March 2015 reporting period; however, the intensity and number of AFP cases in cVDPV outbreaks declined. Inclusion of more tOPV rounds in the steadily improving supplementary immunization activities (SIAs)* and increased access to unimmunized children were important factors for interruption of cVDPV2 outbreaks in Afghanistan and South Sudan and for control of cVDPV2 outbreaks in Nigeria and Pakistan. The new outbreaks in Burma, Guinea, Laos, Madagascar, and Ukraine highlight the importance of maintaining high population immunity to all polioviruses, as well as sensitive AFP surveillance.

The expansion of environmental surveillance in countries at high risk has increased the sensitivity of poliovirus detection. However, detection of polioviruses from sewage presents logistical and technical challenges (*4*), including determination of VDPV genetic signatures (*7*). Determination of epidemiologic linkages from sequence data in environmental isolates represents an additional challenge. For example, highly divergent isolates, most likely representing iVDPVs based on the genetic signature, are classified as aVDPVs because of the absence of epidemiologic linkage to a known immunodeficient patient who is a chronic poliovirus excretor.

The frequency of cVDPV2 detection declined during January 2015–May 2016. However, the emergence of cVDPV2 in countries with low routine vaccination coverage underscores the risks from widening immunization gaps to type 2 polioviruses. The April 29, 2016, report of detection of a cVDPV2 isolate from sewage in Nigeria with 3.5% VP1 divergence suggests that gaps in surveillance had missed virus circulation. In response to this outbreak, three rounds of SIAs with monovalent oral poliovirus vaccine type 2 (mOPV2) were used in accessible areas of Borno State and neighboring districts in two other states (*10*). Detection of aVDPV2 isolates in environmental samples in Kenya and Egypt with six or seven VP1 nucleotide differences (<1 year of replication/circulation) did not lead to a recommendation for use of mOPV2; scope of response is based on risk of spread and the estimated duration of circulation before detection.

WPV2, which has not been detected since 1999, was declared globally eradicated on September 20, 2015, and WPV3 has not been detected worldwide since 2012. A key goal of the polio endgame strategic plan (*6*) is the global cessation of all OPV use, starting with OPV2, which will ultimately eliminate the risk for cVDPV outbreaks and new iVDPV infections. During a 2-week period in April 2016, the Global Polio Eradication Initiative coordinated worldwide withdrawal of tOPV (types 1, 2, and 3) and replacement with bOPV (types 1 and 3), which was accomplished by May 2016 in 150 countries and territories that used any OPV in childhood vaccination schedules. The Global Polio Eradication Initiative and Global Polio Laboratory Network have continued to strengthen AFP and poliovirus surveillance during 2016. Routine immunization services also are being strengthened, and most countries incorporated at least 1 dose of IPV into routine childhood immunization schedules in 2015 (*6*). This was limited from the planned introduction in all 126 countries that used OPV exclusively for routine immunization because of a global IPV supply shortage. To reduce the risk for iVDPV spread from

Summary

What is already known about this topic?

Vaccine-derived polioviruses (VDPVs), genetically divergent strains from the oral poliovirus vaccine (OPV), fall into three classifications: 1) circulating VDPVs (cVDPVs) from outbreaks, 2) immunodeficiency-associated VDPVs (iVDPVs) from patients with primary immunodeficiencies, and 3) ambiguous VDPVs (aVDPVs) that cannot be more definitively identified. cVDPVs emerge in settings of low population immunity, can cause paralysis, and can sustain long-term circulation. Because >94% of cVDPVs isolated since 2006 and 66% of iVDPVs identified since OPV introduction are type 2, and because wild polio virus type 2 was declared eradicated in 2015, the World Health Organization coordinated worldwide replacement of trivalent OPV with bivalent OPV (types 1 and 3) in April 2016.

What is added by this report?

During January 2015–May 2016, new cVDPV outbreaks were identified in Burma, Guinea, Laos, Madagascar, and Ukraine, while cVDPV2 circulation in Nigeria and Pakistan sharply declined. Twenty-one newly identified persons in 10 countries were found to excrete iVDPVs.

What are the implications for public health practice?

The ultimate goal of the Global Polio Eradication Initiative is the cessation of all poliovirus circulation. The risk for iVDPV emergence will continue as long as OPV is used. The switch from trivalent OPV to bivalent OPV in April 2016 was the first step to phasing out the use of all OPV, setting the stage for a total worldwide shift from OPV to IPV.

*Supplementary immunization activities are mass vaccination campaigns conducted over a short period (days to weeks) during which a dose of OPV is administered to all children aged <5 years, regardless of previous vaccination history. Campaigns can be conducted nationally or in selected areas of a country.

long-term chronic excretors, maintenance of high levels of routine vaccination coverage will be necessary during the polio endgame.

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Environmental Isolation of Circulating Vaccine-Derived Poliovirus After Interruption of Wild Poliovirus Transmission — Nigeria, 2016

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In September 2015, more than 1 year after reporting its last wild poliovirus (WPV) case in July 2014 (*1*), Nigeria was removed from the list of countries with endemic poliovirus transmission,* leaving Afghanistan and Pakistan as the only remaining countries with endemic WPV. However, on April 29, 2016, a laboratory-confirmed, circulating vaccine-derived poliovirus type 2 (cVDPV2) isolate was reported from an environmental sample collected in March from a sewage effluent site in Maiduguri Municipal Council, Borno State, a security-compromised area in northeastern Nigeria. VDPVs are genetic variants of the vaccine viruses with the potential to cause paralysis and can circulate in areas with low population immunity. The Nigeria National Polio Emergency Operations Center initiated emergency response activities, including administration of at least 2 doses of oral poliovirus vaccine (OPV) to all children aged <5 years through mass campaigns; retroactive searches for missed cases of acute flaccid paralysis (AFP), and enhanced environmental surveillance. Approximately 1 million children were vaccinated in the first OPV round. Thirteen previously unreported AFP cases were identified. Enhanced environmental surveillance has not resulted in detection of additional VDPV isolates. The detection of persistent circulation of VDPV2 in Borno State highlights the low population immunity, surveillance limitations, and risk for international spread of cVDPVs associated with insurgency-related insecurity. Increasing vaccination coverage with additional targeted supplemental immunization activities and reestablishment of effective routine immunization activities in newly secured and difficult-to-reach areas in Borno is urgently needed.

Borno State, located in northeast Nigeria, shares boundaries with Cameroon, Chad, and Niger (Figure 1). During the last 7 years, security challenges related to armed insurgency in the region have led to mass migration, large territories that are inaccessible to polio eradication activities, and a large population of internally displaced persons living in camps and community housing in Maiduguri, the state capital. Following the detection of the cVDPV2 isolate in Maiduguri, the Nigeria National Polio Emergency Operations Center promptly activated the outbreak response standard operating procedures, which include supplemental immunization activities (SIAs) (mass campaigns intended to provide at least 2 doses of OPV to all children aged <5 years), retroactive searches for missed AFP cases, and enhanced environmental surveillance (*2*).

Genetic sequencing of the isolate indicated the virus differed by 32 nucleotides from Sabin 2 and differeed by 20 nucleotides from the closest matching sequence (VDPV2 lineage), signifying prolonged undetected circulation. This viral lineage was responsible for the 2012–2014 multicountry cVDPV2 outbreak, which started in Chad and spread to Nigeria, Niger, and Cameroon, and was last isolated in 2014 from an environmental sample collected in Yobe State, Nigeria, which borders Borno State to the west (*3*).

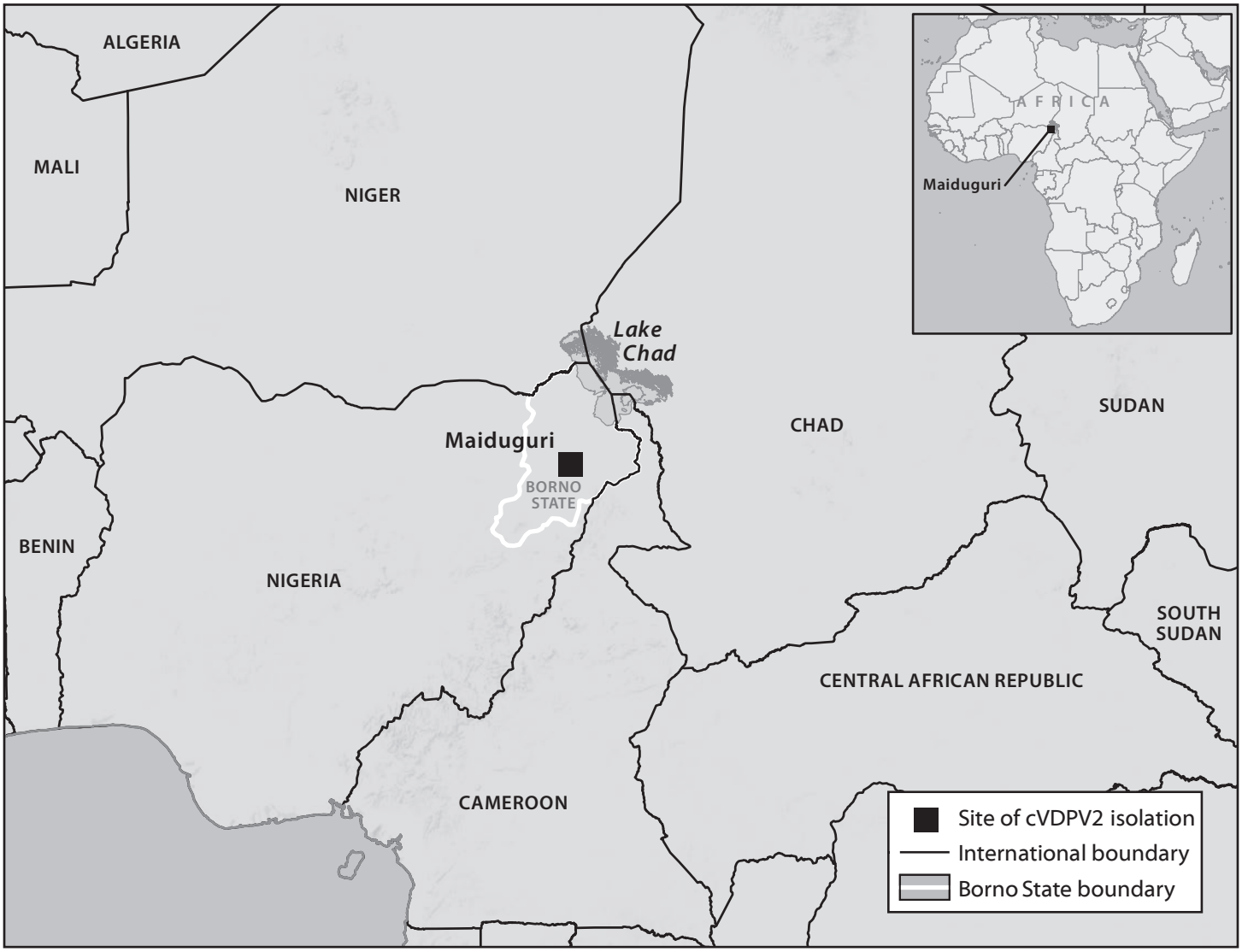
Three outbreak response SIAs were conducted in May, June, and July 2016, targeting children aged <5 years, and using monovalent oral poliovirus vaccine type 2 (mOPV2). The quality of the May SIA was evaluated using lot quality assurance sampling (LQAS) methodology (*4*). Because the cVDPV2 isolate was classified as an orphan (i.e., >1.5% sequence difference from the nearest matching virus), indicating probable gaps in surveillance, a retroactive community AFP case search was conducted in 78,310 households and health facilities in 608 housing settlements in 10 district subdivisions (wards) bordering the environmental sample collection site.

Supplemental Immunization Activities

Among the 310 wards in Borno State's 27 local government areas (LGAs), 137 (44%) were classified as fully accessible, and 17 (6%) were accessible with military escort. The remaining 156 wards (50%) were classified as inaccessible (Figure 2). The first of three outbreak response SIAs using mOPV2 was conducted during May 9–12, 2016, in 23 of the 27 LGAs that were fully or partially accessible in Borno State, and an additional 12 border LGAs in the adjoining Yobe, Gombe, and Adamawa states. A total of 1,329,231 children aged <5 years were vaccinated; LQAS results indicated that 96% of the LGAs assessed passed at a threshold of 80% coverage. The second and third SIA rounds were conducted in June and July 2016. Because of ongoing security concerns, vaccination exercises were conducted by house-to-house, border and special transit teams, and also in health camps.

* Interruption of endemic poliovirus is likely when a country reports no new WPV case over a 1-year period. Certification of eradication occurs only when high-quality surveillance yields no evidence of WPV over a period of 3 consecutive years.

FIGURE 1. Location of the laboratory-confirmed circulating vaccine-derived poliovirus type 2 (cVDPV2) isolate reported from an environmental sewage sample — Maiduguri, Borno State, Nigeria, April 29, 2016



Retroactive AFP Case Search

During April 29–May 31, 2016, a total of 62 AFP cases were identified in Maiduguri Municipal Council, 13 (21%) of which were previously unreported. For four of these 13 cases, <60 days had elapsed from date of onset of paralysis. Preliminary laboratory results indicate that stool samples collected from patients were negative for WPV and cVDPV; however, sample collection was conducted well beyond the recommended 14 days after paralysis onset when two stool specimens should be collected.

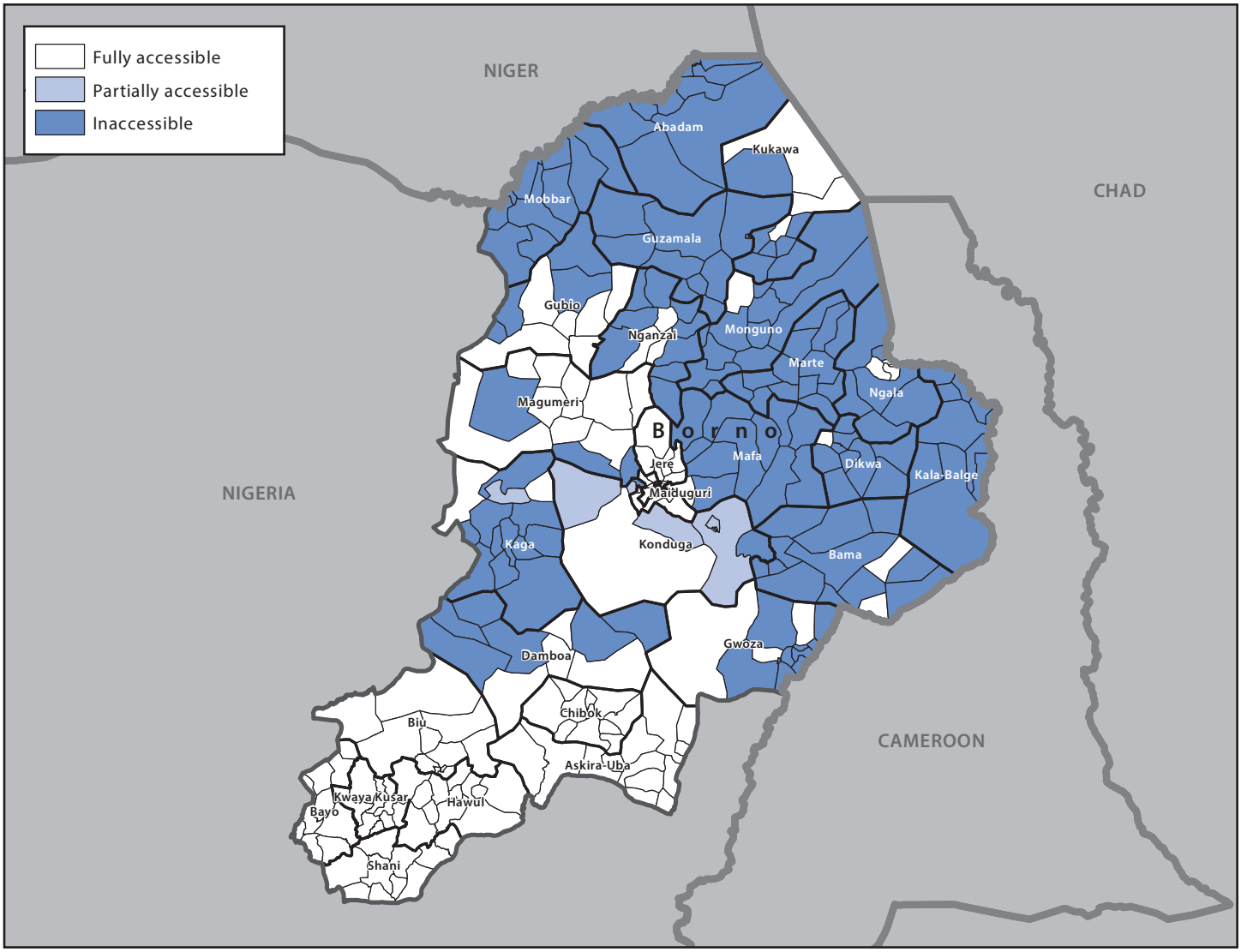
Environmental Surveillance

The frequency of environmental sample collection in Maiduguri was increased from monthly to weekly at each of the four environmental sampling sites. Results for samples collected through May 31, 2016, were negative for WPV and cVDPV.

Discussion

As in many countries, extensive use of OPV, a live, attenuated vaccine, contributed to the interruption of endemic WPV transmission in Nigeria. However, in settings with low routine vaccination coverage, OPV use can be associated with the emergence of VDPVs, genetic variants of the vaccine viruses with the potential to cause paralysis (*5*), and cVDPVs have been implicated in confirmed outbreaks (*6*). In April 2016, approximately 7 months after the official certification of the interruption of WPV transmission in Nigeria, environmental sampling from a sewage effluent site identified a cVDPV2 isolate in Maiduguri Municipal Council, Borno State. Genetic

FIGURE 2. Security-related accessibility classification within the 27 local government areas — Borno State, Nigeria, May 2016



sequencing suggested that the isolated viral strain had been in circulation for at least 2 years. After activation of the Nigeria Polio Emergency Operations Center, SIAs with mOPV2 began, and a retroactive search for AFP cases identified previously unreported AFP cases.

This cVDPV2 isolate is the first to be reported in Nigeria since it was removed from the list of countries with endemic WPV transmission in September 2015, and the first to be reported from any country worldwide after the April 2016 globally coordinated switch from trivalent to bivalent OPV (*7*). The primary aim of the switch was the removal from routine use of the type 2 component of OPV (OPV2), which is associated with most cVDPV outbreaks (*6*,*8*). The use of mOPV2 in the response to the cVDPV2 isolation in Borno marks the first time OPV2-containing vaccine obtained from the global emergency stockpile has been deployed in an outbreak response setting, by authorization of the Director General of the World Health Organization (*9*).

Outbreak response to the viral isolation has been affected by difficulties in geographic access related to security challenges in the region. Evaluations conducted in Borno State during May 2016 indicated that security and accessibility remain major concerns in northeastern Nigeria. Therefore, in spite of the rapid response, immunity gaps likely exist, and the estimated number of children in the inaccessible or poorly accessible areas is currently unknown. Plans to vaccinate children in newly accessible areas and camps of internally displaced persons might mitigate, but will not eliminate, the risk for ongoing or new cVDPV2 transmission. Furthermore, poor accessibility will continue to limit high quality surveillance activities in security-compromised areas.

Although significant progress continues to be made toward polio eradication in Nigeria, the detection of persistent cVDPV2 circulation highlights three key challenges facing Nigeria and the broader global polio eradication efforts. First, low population immunity because of inability to reach or fully immunize children in Borno State risks further outbreaks and spread of cVDPVs and other vaccine-preventable diseases (VPDs). Second, poor access to security-compromised areas might continue to limit timely detection of and appropriate response to potential outbreaks, further compounding the risks of continued disease transmission. Finally, because of large population movements across international boundaries from Borno State, the risk for international spread of cVDPVs and other VPDs remains substantially elevated in this setting.

Identification of opportunities for increasing vaccination coverage, including additional targeted SIAs and reestablishment of effective routine immunization activities in newly secured and difficult-to-reach areas in Borno, is an urgent public health need. Similar activities in neighboring state and national jurisdictions should be prioritized to limit risks for future outbreaks and spread of cVDPVs or other VPDs. A comprehensive surveillance review that aims to identify and close potential case-finding and reporting gaps, within the context of the current security situation in the area, is needed. Finally, ongoing conflict-related mass migration within and between countries in the region requires closer coordination of polio eradication activities, including SIAs and surveillance activities among affected countries, to prevent cVDPV transmission across international boundaries.

Summary

What is known about this topic?

The last case of wild poliovirus transmission in Nigeria was reported in July 2014. The country was officially removed from the list of countries with endemic wild poliovirus transmission in September 2015.

What is added by this report?

In April 2016, a laboratory-confirmed isolate of circulating vaccine-derived poliovirus type 2 (cVDPV2), a genetic variant of the vaccine virus with the potential to cause paralysis, was reported from a sewage effluent site in Borno, a state in northeastern Nigeria with international boundaries. Years of armed insurgency in Borno have led to reduced polio vaccination and surveillance activities, resulting in a population of underimmunized children. The Nigeria National Polio Emergency Operations Center activated an outbreak response that included supplemental immunization activities (SIAs), a retrospective search for acute flaccid paralysis (AFP) cases, and enhanced environmental surveillance. Approximately 1 million children were vaccinated in the first SIA round, and 13 previously unreported AFP cases were identified.

What are the implications for public health practice?

Strategies for increasing vaccination coverage, including deployment of innovative approaches for reaching children in conflict-affected areas, are needed to prevent VDPV and other vaccine preventable disease (VPD) outbreaks. Strengthening surveillance is an urgent priority. Closer coordination of polio eradication activities between state and national jurisdictions in the region should be considered to prevent the potential spread of cVDPV and other VPDs across international boundaries.

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Update: Ongoing Zika Virus Transmission — Puerto Rico, November 1, 2015–July 7, 2016

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Zika virus is a flavivirus transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes, and infection can be asymptomatic or result in an acute febrile illness with rash (*1*). Zika virus infection during pregnancy is a cause of microcephaly and other severe birth defects (*2*). Infection has also been associated with Guillain-Barré syndrome (GBS) (*3*) and severe thrombocytopenia (*4*,*5*). In December 2015, the Puerto Rico Department of Health (PRDH) reported the first locally acquired case of Zika virus infection. This report provides an update to the epidemiology of and public health response to ongoing Zika virus transmission in Puerto Rico (*6*,*7*). A confirmed case of Zika virus infection is defined as a positive result for Zika virus testing by reverse transcription–polymerase chain reaction (RT-PCR) for Zika virus in a blood or urine specimen. A presumptive case is defined as a positive result by Zika virus immunoglobulin M (IgM) enzyme-linked immunosorbent assay (MAC-ELISA)* and a negative result by dengue virus IgM ELISA, or a positive test result by Zika IgM MAC-ELISA in a pregnant woman. An unspecified flavivirus case is defined as positive or equivocal results for both Zika and dengue virus by IgM ELISA. During November 1, 2015–July 7, 2016, a total of 23,487 persons were evaluated by PRDH and CDC Dengue Branch for Zika virus infection, including asymptomatic pregnant women and persons with signs or symptoms consistent with Zika virus disease or suspected GBS; 5,582 (24%) confirmed and presumptive Zika virus cases were identified. Persons with Zika virus infection were residents of 77 (99%) of Puerto Rico's 78 municipalities. During 2016, the percentage of positive Zika virus infection cases among symptomatic males and nonpregnant females who were tested increased from 14% in February to 64% in June. Among 9,343 pregnant women tested, 672 had confirmed or presumptive Zika virus infection, including 441 (66%) symptomatic women and 231 (34%) asymptomatic women. One patient died after developing severe thrombocytopenia (*4*). Evidence of Zika virus infection or recent unspecified flavivirus infection was detected in 21 patients with confirmed GBS. The widespread outbreak and accelerating increase in the number of cases in Puerto Rico warrants intensified vector control and personal protective behaviors to prevent new infections, particularly among pregnant women.

Epidemiologic Surveillance

Epidemiologic surveillance for Zika virus in Puerto Rico has previously been described, and includes testing of all symptomatic persons for evidence of Zika, dengue, or chikungunya virus infection using the Trioplex RT-PCR† or MAC-ELISA tests (*7*). During November 1, 2015–July 7, 2016, specimens from 16,522 symptomatic patients with suspected arboviral disease were evaluated. A total of 5,106 (31%) confirmed and 245 (1%) presumptive Zika virus infections were identified. In addition, test results for 136 (<1%) patients were positive for recent dengue virus infection, results for 127 (<1%) were positive for recent unspecified flavivirus infection, and results for 100 (<1%) were positive for recent chikungunya virus infection. Among the 5,351 symptomatic patients with evidence of recent Zika virus infection, 441 (8%) were pregnant women (Table 1). Thirty-six confirmed or suspected cases of GBS (*8*) were reported to PRDH by providers throughout the island. Among these patients, 21 (61%) had evidence of Zika virus or flavivirus infection, including five (14%) with confirmed and 11 (33%) with presumptive Zika virus infections, and five (14%) with unspecified flavivirus infections. Sixty-five (<1%) of 5,131 symptomatic patients with confirmed or presumptive Zika virus infection required hospitalization, including all GBS patients. One male patient with Zika virus infection died of complications related to severe thrombocytopenia (*4*). Sixty-five infants were born to women with evidence of Zika virus infection in pregnancy, and two pregnancy losses were identified. In one pregnancy loss, Zika virus was identified in neural tissue by immunohistochemistry. No cases of congenital Zika virus infection among live births in Puerto Rico have been

*CDC Zika MAC-ELISA (http://www.fda.gov/downloads/MedicalDevices/Safety/EmergencySituations/UCM488044.pdf).

†Trioplex RT-PCR test (http://www.fda.gov/downloads/MedicalDevices/Safety/EmergencySituations/UCM491592.pdf).

identified. All pregnant women with confirmed or presumptive Zika virus infection, or unspecified flavivirus infection, and their prenatally exposed offspring are being actively monitored for adverse maternal, fetal, neonatal, infant, and child health outcomes through the Zika Active Pregnancy Surveillance System,[§] a collaboration between PRDH and CDC. PRDH has followed CDC recommendations that pregnant women in areas with evidence of active Zika virus transmission receive screening tests during the first and second trimesters of pregnancy, regardless of symptoms (*9*). Among 7,308 asymptomatic pregnant women tested during January–July 2016, 43 (<1%) confirmed and 188 (3%) presumptive Zika virus infections were identified. The percentage of asymptomatic pregnant women with confirmed or presumptive recent Zika virus infection among women tested increased almost sixfold, from 0.8% in February 2016 to 5.3% in June 2016.

The number of Zika virus infections reported each week in Puerto Rico gradually increased during November 2015–February 2016, and remained relatively stable until April 2016 (Figure 1). The number of persons with recent Zika virus infection reported each week began to increase in April 2016, and steadily increased through June. Overall, Puerto Rico reported 291 new confirmed and presumptive Zika virus cases during February 2016; 2,612 new confirmed and presumptive Zika virus cases were reported during June, a nearly eightfold increase. Among symptomatic males and nonpregnant females who were tested, the percentage of persons with confirmed or presumptive Zika virus infection increased threefold from 14% in February to 64% in June; during the same time, the percentage of persons with confirmed or presumptive Zika virus infection among symptomatic pregnant women increased fivefold, from 8% to 41%.

Suspected cases of Zika virus disease were reported in all 78 municipalities, and Zika virus–infected patients were residents of 77 (99%) municipalities (Figure 2). The more populous municipalities of San Juan and Ponce reported the highest numbers of confirmed and presumptive Zika virus cases, with fewer cases occurring in the rural municipalities of Puerto Rico.

On April 3, 2016, local collection of blood donation specimens resumed (the Food and Drug Administration had recommended cessation of blood collection in areas of the United States affected by active vectorborne transmission of Zika virus and importation of all blood components from the continental United States beginning March 5[¶]). Zika virus screening using a nucleic acid test (cobas Zika, Roche Molecular Systems, Inc., Pleasanton, California) was authorized by the Food and Drug Administration under an investigational new drug application (*10*). A blood donation specimen with an initial reactive result by nucleic acid testing is regarded as presumptive positive for Zika virus infection. During the weeks of April 3 through July 3, among 18,163 donation specimens tested, 143 (0.8%) were identified as presumptive positive for Zika virus. The percentage of blood donation specimens testing positive by week has increased, with the highest percentage (1.8%) occurring during the latest week of reporting (week beginning July 3) (Figure 3).

TABLE 1. Pregnant women with test results positive for Zika virus infection — Puerto Rico, November 1, 2015–July 7, 2016

Clinical status	Confirmed positive*	Presumptive positive†	Total tested
Symptomatic	383	58	**2,035**
Asymptomatic	43	188	**7,308**
Total	**426**	**246**	**9,343**

* A confirmed case was defined as a positive result for Zika virus by reverse transcription–polymerase chain reaction testing.
† A presumptive case was defined as a positive result by Zika virus immunoglobulin M enzyme-linked immunosorbent assay.

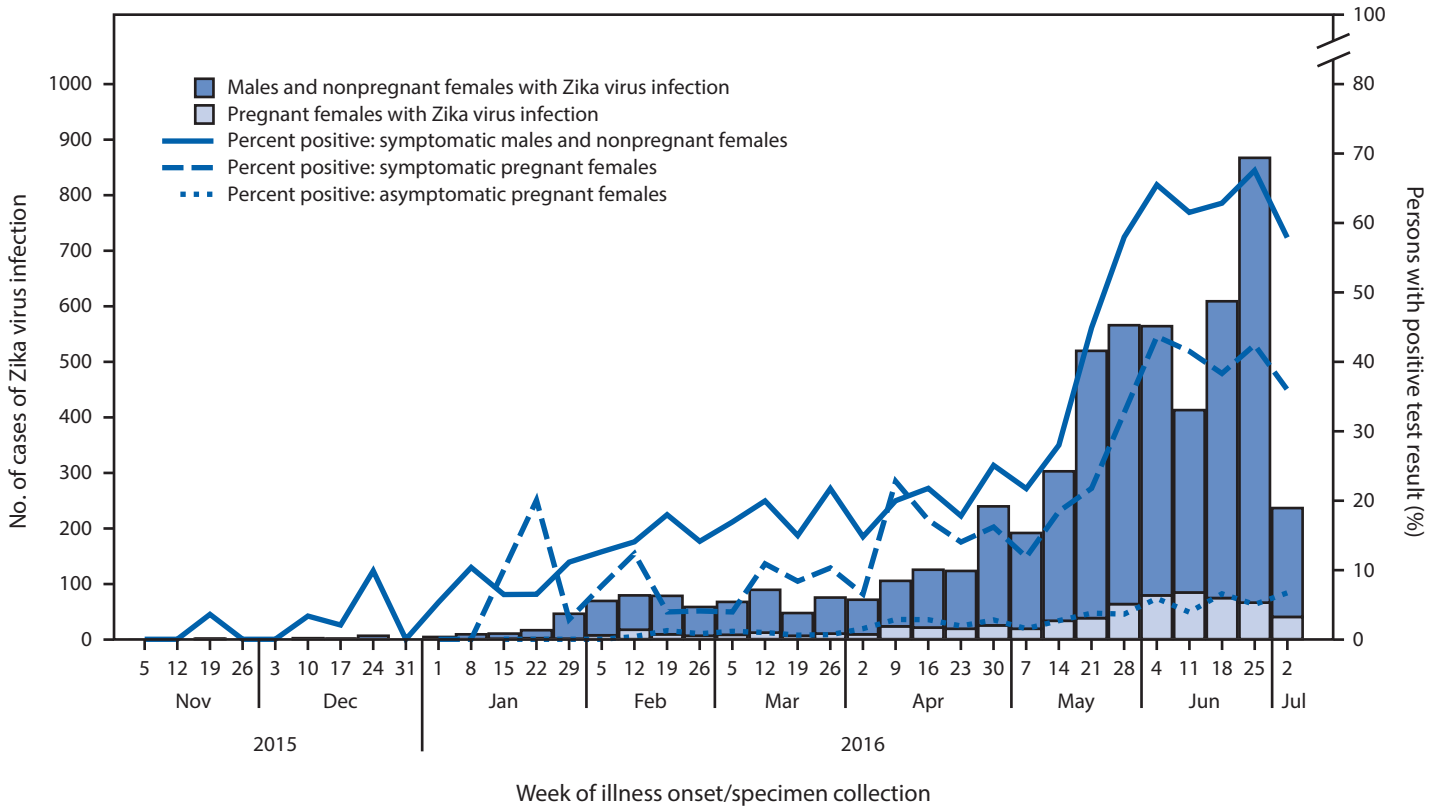
Public Health Response

PRDH, in collaboration with CDC, implemented a Zika virus response strategy with three focus areas: protecting pregnant women, controlling the mosquito vector, and expanding access to the full range of voluntary contraceptive options for women and men. Health messaging, such as television and radio public service announcements, has been implemented, health education materials have been distributed at locations, including health care facilities and community events, and weekly arboviral surveillance reports with island-wide and municipal-level information have been posted online.[**,††] Outreach to travelers has included health messaging via television screens and flyers at ports of entry, hotels, and tourist places of interest as well as training airport and tourism personnel. Community intervention strategies have focused on pregnant women. PRDH has worked closely with Women, Infants, and Children (WIC) clinics, where 90% of pregnant women residing in Puerto Rico received services in 2015 (Dana Miró Medina, LND, WIC Puerto Rico, personal communication, 2016), to provide approximately 12,900 Zika prevention kits to pregnant women; the kits include insect repellent, bed nets, condoms, and larvicide to prevent mosquito breeding sites in water-holding containers around households. Since February 2016, approximately 21,000 pregnant women, representing

§ Zika Active Pregnancy Surveillance System is co-operated by PRDH and CDC.
¶ http://www.fda.gov/downloads/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/Guidances/Blood/UCM486360.pdf.

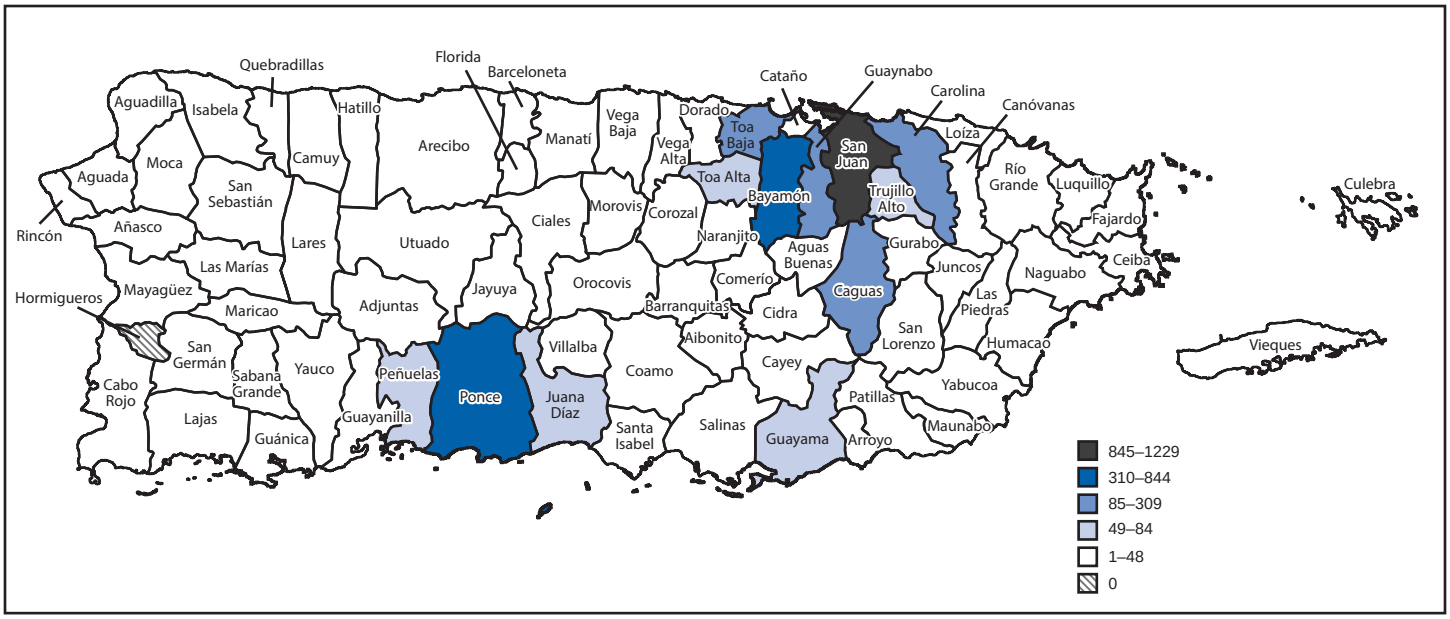
** http://www.salud.gov.pr/Estadisticas-Registros-y-Publicaciones/Informes%20Arbovirales/Forms/AllItems.aspx.
†† http://www.salud.gov.pr/Estadisticas-Registros-y-Publicaciones/Pages/Reporte-de-Zika-por-Municipios.aspx.

FIGURE 1. Cases of confirmed and presumptive Zika virus infection (N = 5,582), by pregnancy status and week of illness onset or specimen collection, and percentage of persons with test results positive for Zika virus — Puerto Rico, November 1, 2015–July 7, 2016*



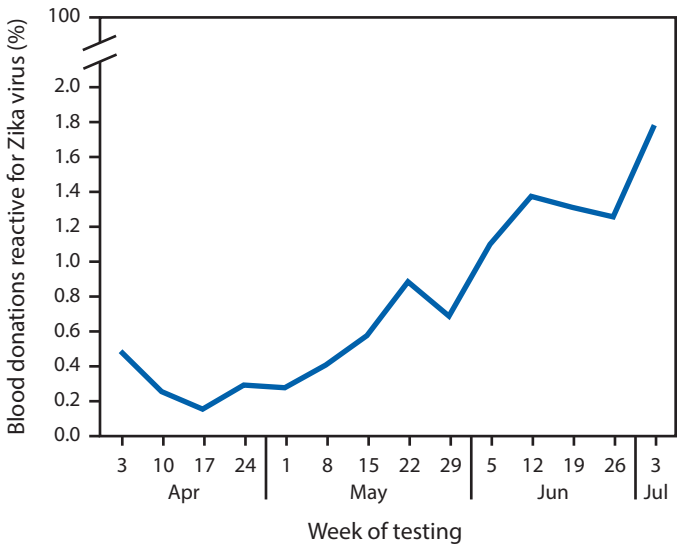
* The decrease in cases for the first week of July 2016 might reflect a reporting delay.

FIGURE 2. Municipality of residence of persons with confirmed and presumptive Zika virus infection (n = 4,986) — Puerto Rico, November 1, 2015–July 7, 2016*



* 596 additional cases were reported in persons with unknown municipality of residence.

FIGURE 3. Percentage of screened blood donations reactive for Zika virus infection, by week of testing — Puerto Rico, April 3–July 3, 2016



approximately 67% of the estimated number of pregnant women per year based on 2015 birth rates, have been counseled about Zika virus prevention at WIC clinics. In addition, to reduce the risk for unintended pregnancies, the public health response includes community outreach and education about sexual transmission of Zika virus, distribution of male and female condoms, and an increase in the availability of the full range of voluntary contraceptive methods, including long-acting reversible contraceptives (*11*). PRDH and CDC have also implemented a representative, population-based survey of women aged 18–49 years to assess contraception use through the Behavioral Risk Factor Surveillance System.

Pregnant women across the island identified through WIC are offered vector control services carried out by a contracted pest control company; these services include source reduction of mosquito breeding sites, larvicide application, and residual indoor and outdoor insecticide spraying with deltamethrin. The Puerto Rico Public Housing Administration has led programs to incorporate residual insecticide spraying with deltamethrin and, in collaboration with Puerto Rico Department of Family Affairs, is working to install screens in the homes of pregnant women.

During February–March 2016, a CDC laboratory in Puerto Rico conducted an insecticide resistance study of *Ae. aegypti* mosquitoes to guide vector control strategies. Mosquitoes from across Puerto Rico were tested using the CDC bottle bioassay (*12*). Results from the laboratory study indicated widespread resistance to pyrethroids throughout the island with the exception of partial resistance to deltamethrin and full susceptibility to naled, an organophosphate insecticide. Insecticide resistance surveillance is ongoing in the CDC laboratory. Use of lethal adult mosquito traps, which have previously been associated with reduced *Ae. aegypti* numbers and incidence of arboviral infections in Puerto Rico, is also under consideration (*13*,*14*).

PRDH and CDC have collaborated to ensure that all public schools are sprayed with deltamethrin before the school year starts in early August. Furthermore, PRDH and the Puerto Rico Emergency Management Agency have collaborated with municipalities to initiate community cleanup campaigns using larvicide to prevent mosquito breeding in water-holding containers around households and to remove mosquito breeding sites, such as trash heaps and septic tanks. In addition, the Puerto Rico Emergency Management Agency and the Puerto Rico Environmental Quality Board have removed approximately 1.6 million rubber tires that could act as mosquito breeding sites.

Women with evidence of Zika virus infection during pregnancy and their exposed offspring are monitored for adverse maternal, fetal, neonatal, infant, and child health outcomes through the Zika Active Pregnancy Surveillance System. Puerto Rico's Birth Defects Surveillance and Prevention System, in collaboration with maternal fetal medicine specialists, monitors the ultrasound findings of pregnant women infected with Zika virus. Beginning in January 2016, the Birth Defects Surveillance and Prevention System began identifying newborns with congenital microcephaly, including those born to women infected with Zika virus during pregnancy. All newborns of women with evidence of Zika virus infection during pregnancy are referred to the Children with Special Health Care Needs program for developmental surveillance and coordinated specialized services, for up to age 3 years as needed. All newborns with congenital microcephaly will be referred to Avanzando Juntos, Puerto Rico's early intervention services system.

Discussion

Both the number of Zika virus infections and percentage of tests among symptomatic persons and asymptomatic pregnant women that are positive are rapidly increasing in Puerto Rico. In addition, unspecified flavivirus cases, while indistinguishable by available laboratory tests, are likely attributable to Zika virus infection, as Zika virus is the predominant circulating flavivirus; Zika virus was identified in 5,351 suspected arboviral cases, compared with 136 dengue cases. Many persons with symptomatic Zika virus infection do not seek medical care or are not reported to public health officials, and most persons with Zika virus infection are asymptomatic (*15*), but can still infect mosquitoes and might unknowingly transmit the virus through sexual contact (*16*), blood donation (*10*), or vertically, to the fetus (*17*). The prevalence of Zika virus infection in Puerto Rico is substantial and increasing, with the most recent data indicating that 5% of asymptomatic pregnant women and 1.8% of blood donations

Summary

What is already known about this topic?

Zika virus transmission in Puerto Rico has been increasing since it was first detected in November 2015. Zika virus infection is a cause of microcephaly and other severe birth defects and has been associated with Guillain-Barré syndrome and severe thrombocytopenia.

What is added by this report?

During November 1, 2015–July 7, 2016, specimens from 16,522 patients with suspected Zika virus disease in Puerto Rico were evaluated and 5,351 (32%) had laboratory evidence of current or recent Zika virus infection. The percentage of persons with confirmed or presumptive Zika virus infection among symptomatic pregnant females increased from 8% in February 2016 to 41% in June 2016; during the same time, the percentage of persons with confirmed or presumptive Zika virus infection among symptomatic males and nonpregnant females increased from 14% to 64%. The public health response includes increased surveillance for Zika virus infection, preventing infection in pregnant women, monitoring infected pregnant women and their fetuses for adverse outcomes, controlling mosquitoes, assuring the safety of blood products, and expanding access to the full range of voluntary contraceptive options for women and men.

What are the implications for public health practice?

The Zika virus outbreak in Puerto Rico continues to expand in geographic extent and number of infected persons. Residents of and travelers to Puerto Rico should continue to employ mosquito bite avoidance behaviors, take precautions to reduce the risk for sexual transmission, and seek medical care for any acute illness with rash or fever. Intensified vector control measures, including an integrated vector management strategy, are needed to help reduce disease spread. Clinicians who suspect Zika virus disease in patients who reside in or have recently returned from areas with ongoing Zika virus transmission should consider testing for Zika virus and report cases to public health officials.

have evidence of recent infection in the most recent reported week of screening (week beginning July 3) (*10*).

Since the introduction of Zika virus to Puerto Rico in late 2015, the virus has spread to nearly all municipalities. The pattern of spread in Puerto Rico is consistent with that of newly introduced arboviruses into an immunologically naive population: transmission began in the heavily populated eastern region and subsequently spread to the southern and western parts of the island, with lower infection rates in the central mountainous regions (*18*,*19*). Arboviral outbreaks in Puerto Rico tend to peak in the late summer and fall, coincident with hotter months with higher rainfall, raising concern that the outbreak will continue and the incidence will increase during the coming months (*18*,*19*).

Patterns observed after the introduction of other arboviruses into Puerto Rico, and evidence that the Zika virus outbreak exhibits no signs of abating, underscore the critical need for rapid, intensified measures to prevent infections among pregnant women. Surveillance data indicate that during June 2016, despite current interventions, approximately 322 pregnant women received diagnoses of having been newly infected in Puerto Rico, emphasizing the need for an aggressive, integrated vector management strategy coupled with intensive counseling and care for pregnant women.

Measures to strengthen vector control in Puerto Rico include more intensive source reduction and larvicide application activities, community engagement, use of lethal adult mosquito traps, and consideration of strategies for vector control with insecticides to which local populations of *Ae. aegypti* are susceptible. A preliminary CDC evaluation of residual insecticide spraying indicates that adult mosquito populations in and around sprayed homes remained comparable to counts in and around unsprayed homes, probably as a result of movement of mosquitoes from nearby homes with breeding sources.

Residents of and travelers to Puerto Rico should continue to employ mosquito bite avoidance behaviors, including using mosquito repellents, wearing long-sleeved shirts and pants, and ensuring that windows and doors have screens, and air conditioning is used, to avoid bites while indoors.[§§] To reduce the risk for sexual transmission, especially to pregnant women, precautions should include consistent and correct use of condoms or abstinence (*20*).Women in Puerto Rico who do not desire pregnancy need access to effective and affordable voluntary contraception to avoid unintended pregnancies (*11*).[¶¶] Clinicians who suspect Zika virus disease in patients who reside in or have recently returned from areas such as Puerto Rico with ongoing Zika virus transmission should consider testing for Zika virus and report cases to public health officials.

[§§] http://www.cdc.gov/zika/prevention/.

[¶¶] http://www.cdc.gov/reproductivehealth/UnintendedPregnancy/Contraception.htm.

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Contraceptive Use Among Nonpregnant and Postpartum Women at Risk for Unintended Pregnancy, and Female High School Students, in the Context of Zika Preparedness — United States, 2011–2013 and 2015

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Zika virus infection during pregnancy can cause congenital microcephaly and brain abnormalities (*1*,*2*). Since 2015, Zika virus has been spreading through much of the World Health Organization's Region of the Americas, including U.S. territories. Zika virus is spread through the bite of *Aedes aegypti* or *Aedes albopictus* mosquitoes, by sex with an infected partner, or from a pregnant woman to her fetus during pregnancy.* CDC estimates that 41 states are in the potential range of *Aedes aegypti* or *Aedes albopictus* mosquitoes (*3*), and on July 29, 2016, the Florida Department of Health identified an area in one neighborhood of Miami where Zika virus infections in multiple persons are being spread by bites of local mosquitoes. These are the first known cases of local mosquito-borne Zika virus transmission in the continental United States.† CDC prevention efforts include mosquito surveillance and control, targeted education about Zika virus and condom use to prevent sexual transmission, and guidance for providers on contraceptive counseling to reduce unintended pregnancy. To estimate the prevalence of contraceptive use among nonpregnant and postpartum women at risk for unintended pregnancy and sexually active female high school students living in the 41 states where mosquito-borne transmission might be possible, CDC used 2011–2013 and 2015 survey data from four state-based surveillance systems: the Behavioral Risk Factor Surveillance System (BRFSS, 2011–2013), which surveys adult women; the Pregnancy Risk Assessment Monitoring System (PRAMS, 2013) and the Maternal and Infant Health Assessment (MIHA, 2013), which surveys women with a recent live birth; and the Youth Risk Behavior Survey (YRBS, 2015), which surveys students in grades 9–12. CDC defines an unintended pregnancy as one that is either unwanted (i.e., the pregnancy occurred when no children, or no more children, were desired) or mistimed (i.e., the pregnancy occurred earlier than desired). The proportion of women at risk for unintended pregnancy who used a highly effective reversible method, known as long-acting reversible contraception (LARC), ranged from 5.5% to 18.9% for BRFSS-surveyed women and 6.9% to 30.5% for PRAMS/MIHA–surveyed women. The proportion of women not using any contraception ranged from 12.3% to 34.3% (BRFSS) and from 3.5% to 15.3% (PRAMS/MIHA). YRBS data indicated that among sexually active female high school students, use of LARC at last intercourse ranged from 1.7% to 8.4%, and use of no contraception ranged from 7.3% to 22.8%. In the context of Zika preparedness, the full range of contraceptive methods approved by the Food and Drug Administration (FDA), including LARC, should be readily available and accessible for women who want to avoid or delay pregnancy. Given low rates of LARC use, states can implement strategies to remove barriers to the access and availability of LARC including high device costs, limited provider reimbursement, lack of training for providers serving women and adolescents on insertion and removal of LARC, provider lack of knowledge and misperceptions about LARC, limited availability of youth-friendly services that address adolescent confidentiality concerns, inadequate client-centered counseling, and low consumer awareness of the range of contraceptive methods available.

BRFSS is a cross-sectional, random-digit–dialed, state-based telephone survey that collects data on risk behaviors and preventive health practices among adult respondents living in all 50 states, the District of Columbia, Puerto Rico, Guam, and the U.S. Virgin Islands.§ Data from 17 states that might be at risk for mosquito-borne transmission of Zika virus (*3*) and had implemented questions on self-reported contraceptive use as part of the BRFSS Family Planning module in 2011 or as state-added questions in 2012 or 2013 were used to estimate use of contraception among women aged 18–44 years at risk for unintended pregnancy.¶ PRAMS is an ongoing state-based and population-based surveillance system designed to monitor selected self-reported maternal behaviors and experiences that occur before, during, and after pregnancy among women who recently delivered a live-born infant.** Data from 28 PRAMS

* http://www.cdc.gov/zika/transmission/.

† http://www.cdc.gov/media/releases/2016/p0729-florida-zika-cases.html; http://www.cdc.gov/zika/intheus/florida-update.html.

§ http://www.cdc.gov/brfss/annual_data/2013/pdf/overview_2013.pdf.

¶ For BRFSS, women were considered at risk for unintended pregnancy if they were not currently pregnant, were sexually active (not abstinent), and, the last time they had sex, had not had a hysterectomy, did not have a same-sex partner, and did not want a pregnancy.

** http://www.cdc.gov/PRAMS/index.htm.

states, reporting in 2013, were used to estimate contraceptive use at the time of the survey (4–6 months postpartum) among women aged 15–44 years with a recent live birth who were at risk for unintended pregnancy.†† PRAMS sites were included if they might be at risk for mosquito-borne transmission of Zika virus (*3*) and achieved a weighted response rate of ≥55%.§§ The 2013 MIHA was used to estimate contraceptive use for postpartum women in California. Using methods comparable to PRAMS, MIHA is an annual, statewide-representative survey of women with a recent live birth.¶¶ YRBSs are conducted by state health and education agencies among representative samples of students in grades 9–12, to monitor health-risk behaviors, including sexual behaviors related to unintended pregnancy and sexually transmitted diseases.*** Data from 2015 YRBSs conducted in 28 states that might be at risk for mosquito-borne transmission of Zika virus (*3*) were used to describe contraceptive use among female high school students at last sexual intercourse.†††

For all data sources, contraceptive use was classified according to the estimated percentage of users who experience pregnancy during the first year of typical use as highly effective (<1%), moderately effective (6%–10%), and less effective (>10%) (*4*). Among women reporting more than one contraceptive method, the most effective method was coded. Highly effective, permanent contraceptive methods included female sterilization, tubal ligation, or partner vasectomy. Highly effective LARC methods included intrauterine devices (IUDs) and contraceptive implants. Moderately effective contraceptive methods included hormone injections, contraceptive pills, transdermal contraceptive patches, and vaginal rings. Less effective methods included diaphragm, condoms (male or female), cervical cap, sponge, withdrawal, spermicide, fertility-based awareness methods, emergency contraception, and "other." Data for the use of permanent contraceptive methods, although included in the denominator for calculating percentages, are not presented because women reporting female sterilization or partner vasectomy do not need ongoing contraceptive services.§§§

Weighted prevalence estimates and 95% confidence intervals for contraceptive use were calculated overall and by age group, as appropriate (BRFSS: ages 18–24, 25–34, and 35–44 years; PRAMS/MIHA: ages 15–19, 20–24, 25–34, and 35–44 years) and by race/ethnicity (non-Hispanic white [white], non-Hispanic black [black], and Hispanic). For all surveys, non-Hispanic other race was included in the denominator, but not presented because of small sample sizes. PRAMS/MIHA data were used to estimate the prevalence of contraceptive use by insurance status (private insurance, Medicaid, and none)¶¶¶; other insurance was not presented because of small sample sizes. Estimates were excluded when they did not meet the reliability standard established for each surveillance system.****

In the 17 states for which BRFSS data were available, use of LARC at last sexual intercourse among women aged 18–44 years at risk for unintended pregnancy ranged from 5.5% (Arizona) to 18.9% (Utah) (Table 1). The proportion of women at risk for unintended pregnancy who used no contraception was lowest in Vermont (12.3%) and highest in Tennessee (34.3%). For all states, moderately and less effective contraception use was lower among older women (available at https://stacks.cdc.gov/view/cdc/40511). Use of less effective contraception was more common among Hispanic women than among white women (available at https://stacks.cdc.gov/view/cdc/40511).

PRAMS and MIHA data indicated that the proportion of women aged 15–44 years at risk for unintended pregnancy using LARC during the postpartum period ranged from 6.9% (New Jersey) to 30.5% (Utah) (Table 2) and was typically highest among adolescents aged 15–19 years (available at https://stacks.cdc.gov/view/cdc/40512). The proportion of postpartum women at risk for unintended pregnancy who did not use contraception ranged from 3.5% (Vermont) to 15.3% (Hawaii). In general, use of LARC and moderately effective contraception was lower in older women (available at https://stacks.cdc.gov/view/cdc/40512). The proportion of women using less effective contraceptive methods tended to be higher among white and Hispanic women than black women (available at https://stacks.cdc.gov/view/cdc/40512). Among

†† For PRAMS, women were considered at risk for unintended pregnancy if they were not currently pregnant, did not want a pregnancy, were sexually active (not abstinent), and did not report another reason they could not get pregnant (i.e., had a same-sex partner, had a hysterectomy/oopherectomy, or were infertile).

§§ PRAMS uses a minimum 60% response rate for publication. However, based on the critical need to report surveillance data related to Zika virus, PRAMS provided permission to use a lower response rate threshold.

¶¶ MIHA uses the same definition of unintended pregnancy as PRAMS.

*** http://www.cdc.gov/healthyyouth/data/yrbs/methods.htm.

††† Female high school students were considered currently sexually active if they had sexual intercourse with at least one person during the 3 months before the survey. In 2015, 30.1% of female high school students nationwide were currently sexually active. http://www.cdc.gov/mmwr/volumes/65/ss/ss6506a1.htm.

§§§ In BRFSS, use of highly effective, permanent contraception ranged from 11.7% to 29.4%; in PRAMS use of highly effective, permanent contraception ranged from 7.5% to 18.8%. YRBSs do not collect information on highly effective, permanent methods of contraception.

¶¶¶ Insurance status was reported at the time of survey, between 4 and 6 months postpartum.

**** BRFSS data were excluded if unweighted denominators had <50 respondents or a relative standard error >30%. PRAMS and MIHA data were suppressed if unweighted denominators had <30 respondents; estimates based on <60 respondents were flagged and should be interpreted with caution. YRBS data were suppressed if there were <100 respondents.

TABLE 1. Use of contraception* at last sexual intercourse among women aged 18–44 years at risk for unintended pregnancy,† by selected states where mosquito-borne Zika virus transmission might be possible and data were available — 10 states§ with state-added questions on reproductive health, Behavioral Risk Factor Surveillance System (BRFSS) survey, 2013, two states¶ with state-added questions on reproductive health (BRFSS, 2012) and five states with state-added questions on reproductive health (BRFSS, 2011)**

State	Unweighted no.	Weighted no.	Highly effective, reversible (LARC)†† % (95% CI)	Moderately effective§§ % (95% CI)	Less effective¶¶ % (95% CI)	None % (95% CI)
Arizona	307	538,319	5.5 (3.4–8.9)	17.9 (12.5–25.1)	23.6 (17.3–31.2)	32.0 (25.1–39.9)
Colorado	587	599,782	15.4 (12.2–19.3)	27.7 (23.6–32.2)	17.1 (13.7–21.1)	15.8 (12.6–19.6)
Connecticut	547	440,679	9.6 (6.2–14.6)	25.4 (19.5–32.4)	23.2 (18.0–29.2)	26.1 (20.5–32.6)
Florida	762	1,334,658	6.8 (4.6–10.0)	16.6 (13.2–20.6)	25.0 (20.4–30.1)	27.5 (22.9–32.6)
Kentucky	884	523,533	6.9 (5.1–9.3)	24.2 (20.5–28.4)	18.0 (14.8–21.7)	22.8 (19.1–27.0)
Massachusetts	753	866,004	14.0 (10.6–18.1)	23.9 (19.4–29.2)	20.2 (16.3–24.8)	30.2 (24.6–36.5)
Mississippi	461	325,091	6.5 (4.2–9.8)	21.4 (17.2–26.3)	24.9 (20.2–30.4)	18.7 (14.8–23.4)
Missouri	418	502,152	7.6 (5.2–11.1)	17.5 (13.3–22.7)	23.4 (18.0–29.8)	25.2 (19.8–31.4)
New York	2,728	2,135,002	11.8 (7.3–18.6)	26.0 (20.3–32.7)	26.1 (20.8–32.2)	22.2 (17.6–27.5)
North Carolina	676	691,264	8.3 (5.9–11.6)	22.7 (18.5–27.4)	24.3 (20.0–29.2)	24.2 (20.2–28.7)
Ohio	658	1,386,428	10.0 (7.3–13.5)	21.6 (17.6–26.2)	18.7 (14.5–23.8)	29.4 (24.9–34.3)
Pennsylvania	1,821	1,336,494	7.6 (6.1–9.4)	22.6 (20.1–25.3)	24.7 (21.8–27.9)	24.1 (21.0–27.3)
South Carolina	1,356	543,085	6.6 (4.9–9.0)	26.6 (23.3–30.2)	21.0 (18.3–23.9)	22.7 (19.7–26.0)
Tennessee	557	592,990	6.5 (3.9–10.6)	13.8 (9.2–20.1)	16.0 (11.1–22.6)	34.3 (27.4–42.0)
Texas	347	3,061,291	10.1 (5.5–17.7)	23.1 (17.6–29.8)	17.3 (12.5–23.5)	26.1 (20.2–33.1)
Utah	656	256,840	18.9 (15.3–23.0)	20.7 (17.2–24.6)	21.7 (18.0–25.8)	18.9 (15.5–23.0)
Vermont	605	70,062	13.8 (11.0–17.3)	30.2 (25.6–35.2)	20.8 (17.0–25.2)	12.3 (9.4–16.0)

Abbreviations: LARC = long-acting, reversible contraception; CI = confidence interval.

* Women using permanent contraception were included in the denominator for all estimates.

† Women were considered at risk for unintended pregnancy if they were not currently pregnant, were sexually active (not abstinent), and, the last time they had sex, had not had a hysterectomy, did not have a same-sex partner, and did not want a pregnancy.

§ Arizona, Connecticut, Kentucky, Massachusetts, Mississippi, New York (data collected April 2013–March 2014), Ohio, Texas, Utah, and Vermont.

¶ Pennsylvania and Colorado.

** Florida, Missouri, North Carolina, South Carolina, and Tennessee.

†† Highly effective, reversible contraceptive methods or LARC include intrauterine devices and implants.

§§ Moderately effective contraceptive methods include hormone injections, contraceptive pills, transdermal contraceptive patch, and vaginal ring.

¶¶ Less effective contraceptive methods include diaphragm, condoms (male or female), cervical cap, sponge, withdrawal, spermicide, fertility-based awareness methods, emergency contraception, and "other." Respondents answering "other" were given the opportunity to write in a response, which was evaluated and reclassified into existing contraceptive method options as appropriate. For Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas and Utah, text responses for "other" contraception were evaluated and reclassified into appropriate categories when possible. The text field was not available for other states.

women with no insurance, use of LARC ranged from 5.3% (New Jersey) to 34.2% (Utah) (available at https://stacks.cdc.gov/view/cdc/40513).

YRBS data indicated that among currently sexually active female high school students in 28 states, LARC use ranged from <2% (North Carolina and Pennsylvania) to 8.4% (Vermont) (Table 3). Use of less effective contraceptive methods ranged from 36.3% (Vermont) to 59.9% (Florida); the proportion of sexually active female high school students not using any contraception was lowest in Vermont (7.3%) and highest in Arkansas (22.8%). Limited data were available to describe sexually active female high school students using contraception by method effectiveness and race/ethnicity (available at https://stacks.cdc.gov/view/cdc/40514).

Discussion

During 2011–2013 and 2015, nonpregnant and postpartum women at risk for unintended pregnancy, and sexually active female high school students in states that might be at risk for mosquito-borne transmission of Zika virus, used moderately effective and less effective contraceptive methods most frequently; use of no contraception varied among states. LARC was used by fewer than one fourth of nonpregnant women, approximately one third of women who recently delivered a live birth, and fewer than one tenth of sexually active female high school students. LARC use also varied by state, age group, race/ethnicity, and insurance status. Increasing accessibility of contraceptive services, including LARC, can reduce unintended pregnancy, including the number of pregnancies affected by Zika virus infection among women who are returning, or whose partners are returning, from areas with ongoing Zika virus transmission (*5*).

Despite the availability of a wide range of FDA-approved contraceptives, unintended pregnancy remains common in the United States; the most recent estimates indicate that 45% of all pregnancies are unintended (*6*), with variation across states (*7*) and by age group, income, education, and race/ethnicity (*6*). LARC methods are highly effective, reversible methods for reducing unintended pregnancy, do not depend on user compliance, and are medically appropriate for most female

TABLE 2. Use of postpartum contraception* among women aged 15–44 years who recently had a live birth and were at risk for unintended pregnancy,† by selected states where mosquito-borne Zika virus transmission might be possible and data were available — Pregnancy Risk Assessment Monitoring System and Maternal Infant and Health Assessment,§ 2013

State	Unweighted no.	Weighted no.	Highly effective, reversible (LARC)¶ % (95% CI)	Moderately effective** % (95% CI)	Less effective†† % (95% CI)	None % (95% CI)
Arkansas	872	29,978	13.1 (9.9–17.2)	35.5 (30.7–40.7)	26.8 (22.4–31.7)	5.8 (3.9–8.6)
California	6,037	414,243	15.4 (13.7–17.1)	29.2 (26.9–31.5)	37.6 (35.0–40.2)	6.2 (5.0–7.4)
Colorado	1,466	56,393	24.7 (21.8–28.0)	26.0 (22.9–29.2)	30.3 (27.1–33.7)	5.6 (4.2– 7.4)
Connecticut	1,021	29,364	20.9 (17.7–24.5)	28.5 (25.0–32.2)	35.2 (31.0–39.7)	7.9 (5.7–10.8)
Florida	1,103	179,043	14.7 (12.4–17.4)	32.8 (29.5–36.3)	28.9 (25.8–32.2)	8.0 (6.2–10.1)
Georgia	665	58,334	18.5 (14.2–23.6)	39.0 (33.3–45.0)	15.6 (11.7–20.5)	8.7 (5.9–12.5)
Hawaii	1,216	15,075	17.8 (15.0–21.0)	33.4 (30.0–37.1)	24.6 (21.5–28.0)	15.3 (12.6–18.4)
Illinois	1,156	123,604	16.8 (14.6–19.4)	34.9 (31.9–38.0)	30.3 (27.5–33.2)	7.5 (6.0–9.4)
Iowa	1,012	32,421	18.9 (15.7–22.7)	37.3 (33.0–41.8)	24.3 (20.7–28.4)	4.6 (3.1–7.0)
Louisiana	1,316	51,925	10.8 (8.7–13.4)	42.7 (39.1–46.4)	23.6 (20.6–27.0)	8.1 (6.3–10.5)
Maine	809	10,519	25.5 (22.1–29.1)	28.0 (24.6–31.7)	27.2 (23.8–30.8)	6.9 (5.2–9.3)
Maryland	1,047	52,718	12.7 (10.5–15.4)	34.5 (31.2–38.0)	32.1 (28.9–35.5)	10.7 (8.6–13.1)
Massachusetts	1,203	57,967	20.8 (17.9–24.0)	33.2 (29.6–37.0)	32.0 (28.5–35.7)	5.0 (3.6–6.9)
Minnesota	1,140	56,367	20.0 (17.4–22.8)	31.3 (28.3–34.4)	31.7 (28.7–34.8)	7.1 (5.6–9.1)
Missouri	1,030	62,628	19.2 (16.6–22.0)	31.5 (28.4–34.8)	29.0 (26.0–32.2)	5.9 (4.4–7.7)
Nebraska	1,352	21,887	16.4 (14.2–18.9)	32.6 (29.7–35.7)	30.7 (27.8–33.6)	8.3 (6.7–10.2)
New Hampshire	550	10,793	23.8 (19.7–28.5)	29.0 (24.7–33.8)	27.8 (23.5–32.4)	5.8 (3.9–8.6)
New Jersey	742	51,983	6.9 (5.1–9.3)	32.8 (29.2–36.7)	35.4 (31.7–39.3)	11.6 (9.3–14.4)
New Mexico	1,435	21,521	26.7 (24.3–29.3)	33.4 (30.8–36.0)	20.8 (18.6–23.2)	5.9 (4.7–7.3)
New York§§	976	87,301	13.6 (10.8–17.1)	32.6 (28.4–37.2)	32.1 (28.0–36.5)	9.4 (6.9–12.5)
Ohio	1,237	113,373	14.4 (12.0–17.2)	34.7 (31.3–38.3)	26.3 (23.3–29.6)	8.8 (7.0–11.1)
Oklahoma	1,598	44,927	19.3 (16.1–22.9)	35.3 (31.3–39.5)	22.7 (19.4–26.4)	6.2 (4.5–8.4)
Pennsylvania	874	110,078	12.5 (10.1–15.2)	33.8 (30.3–37.5)	34.3 (30.8–37.9)	8.2 (6.4–10.5)
Rhode Island	1,002	8,604	25.4 (22.6–28.5)	31.8 (28.6–35.0)	24.3 (21.5–27.4)	5.5 (4.1–7.2)
Tennessee	632	65,647	13.0 (10.0–16.8)	41.6 (36.8–46.6)	21.3 (17.5–25.6)	6.2 (4.1–9.1)
Texas	1,046	322,651	14.7 (12.2–17.7)	32.4 (29.0–36.0)	33.1 (29.6–36.8)	5.4 (3.9–7.4)
Utah	1,250	44,789	30.5 (27.4–33.7)	25.8 (22.9–28.9)	29.9 (26.8–33.2)	5.7 (4.3–7.5)
Vermont	832	5,040	23.6 (20.7–26.7)	30.2 (27.1–33.6)	30.8 (27.7–34.1)	3.5 (2.4–5.0)
Wisconsin	1,277	53,629	16.6 (13.6–20.2)	34.7 (30.7–38.9)	29.6 (25.8–33.8)	6.2 (4.3–8.9)

Abbreviations: LARC = long-acting, reversible contraception; CI = confidence interval.

* Women using permanent contraception were included in the denominator for all estimates.

† Women were considered at risk for unintended pregnancy if they were not currently pregnant, did not want a pregnancy, were sexually active (not abstinent), and did not report another reason they could not get pregnant (i.e., had a same-sex partner, had a hysterectomy/oopherectomy, or were infertile).

§ MIHA is an annual population-based survey of California resident women with a live birth, with a sample size of 7,010 in 2013. Prevalence and 95% confidence intervals are weighted to represent all women with a live birth in California in 2013.

¶ Highly effective, reversible contraceptive methods or LARC include intrauterine devices and implants.

** Moderately effective contraceptive methods include hormone injections, contraceptive pills, transdermal contraceptive patch, and vaginal ring.

†† Less effective contraceptive methods include diaphragm, condoms (male or female), cervical cap, sponge, withdrawal, spermicide, fertility-based awareness methods, emergency contraception, and "other." Respondents answering "other" were given the opportunity to write in a response, which was evaluated and reclassified into existing contraceptive method options as appropriate.

§§ Does not include New York City.

adolescents and adult women (*4*,*8*). Nationally, although use of LARC methods nearly doubled in recent years (*9*), use remains lower than that of other reversible contraceptives such as oral contraceptive pills and condoms (*9*), and considerable barriers to access and contraceptive method availability remain (*10*).

The most recent estimates for the United States suggest that lower income women had rates of unintended pregnancy up to five times higher than women with higher incomes (*6*). During 2000–2010, the need for publicly funded contraceptive services increased 17% (*11*).†††† Although publicly funded providers met approximately 42% of contraceptive need in 2013, unmet need varied by state, suggesting gaps in access to subsidized contraceptive care (*11*). Among low income women with Medicaid insurance, recent guidance emphasizes provision of contraceptive services without cost-sharing.§§§§ Also, whereas women with private insurance coverage reported decreased out-of-pocket costs for LARC following the 2012 Affordable Care Act requirement for most private health plans to cover contraceptive services, 13% of women continued to cost-share (*12*), further highlighting differences in access and availability (*13*). Although federal regulations for publicly funded coverage enable minors to obtain contraceptive care without parental

†††† Need is defined as sexually active women with a family income below 250% of the federal poverty level and all women younger than age 20 years, who are able to conceive and were not intentionally trying to get pregnant.

§§§§ https://www.medicaid.gov/federal-policy-guidance/downloads/sho16008.pdf.

TABLE 3. Use of contraception at last sexual intercourse among female students in grades 9–12 who were currently sexually active,* by selected states where mosquito-borne Zika virus transmission might be possible and data were available — Youth Risk Behavior Survey, 2015

State	Unweighted no.	Highly effective, reversible (LARC)† % (95% CI)	Moderately effective§ % (95% CI)	Less effective¶ % (95% CI)	None % (95% CI)
Alabama	204	2.9 (1.2–6.5)	36.2 (27.6–45.7)	39.7 (34.1–45.6)	18.5 (12.6–26.5)
Arizona	319	5.4 (2.0–13.8)	23.5 (14.8–35.3)	54.3 (48.1–60.4)	15.3 (9.4–23.9)
Arkansas	378	2.4 (0.9–6.2)	30.1 (22.3–39.1)	43.2 (32.8–54.2)	22.8 (18.2–28.3)
California	199	5.3 (2.4–11.3)	19.9 (13.0–29.2)	55.3 (48.1–62.2)	12.4 (8.9–16.9)
Connecticut	245	3.8 (2.0–7.4)	32.0 (24.6–40.6)	48.9 (40.3–57.6)	12.3 (7.8–18.7)
Delaware	399	4.3 (2.4–7.5)	30.8 (25.5–36.6)	48.6 (41.6–55.7)	14.1 (8.0–23.6)
Florida	669	2.0 (1.1–3.5)	19.7 (16.1–23.8)	59.9 (54.9–64.7)	16.5 (14.0–19.3)
Hawaii	687	6.1 (3.1–11.5)	25.3 (21.3–29.8)	54.8 (48.4–61.1)	11.4 (7.8–16.4)
Illinois	363	4.8 (2.7–8.6)	36.7 (27.0–47.6)	46.2 (38.2–54.4)	11.8 (8.0–16.9)
Indiana	237	5.0 (2.4–10.0)	32.1 (22.3–43.9)	44.0 (36.2–52.0)	16.3 (10.7–24.0)
Kentucky	325	7.8 (3.9–15.1)	36.6 (27.6–46.6)	37.0 (28.0–47.0)	17.5 (13.9–22.0)
Maine	1196	6.4 (4.1–9.9)	43.6 (41.2–46.1)	40.5 (36.9–44.2)	8.6 (6.9–10.7)
Maryland	5,572	2.6 (2.1–3.2)	27.8 (26.4–29.3)	52.8 (51.2–54.3)	15.3 (14.0–16.7)
Massachusetts	388	6.0 (3.6–10.1)	36.2 (30.3–42.6)	48.1 (40.9–55.3)	9.2 (6.7–12.6)
Mississippi	246	4.8 (2.6–8.8)	30.8 (23.5–39.3)	49.7 (42.8–56.6)	14.0 (8.5–22.2)
Missouri	172	4.9 (2.5–9.2)	35.8 (27.1–45.6)	48.1 (41.8–54.3)	10.5 (5.6–19.0)
Nebraska	173	5.0 (2.3–10.2)	28.9 (21.5–37.5)	45.6 (36.2–55.4)	19.0 (11.9–29.0)
Nevada	183	2.7 (0.6–11.1)	28.8 (18.3–42.3)	54.8 (40.2–68.6)	13.8 (9.7–19.1)
New Hampshire	2,239	6.6 (5.4–8.0)	43.6 (40.1–47.2)	41.6 (38.0–45.3)	7.4 (6.0–9.0)
New Mexico	968	7.8 (6.0–10.2)	25.7 (22.3–29.5)	45.9 (41.6–50.3)	17.5 (14.2–21.2)
New York	930	4.7 (2.1–10.5)	30.4 (24.8–36.5)	49.6 (41.8–57.5)	13.6 (10.9–16.9)
North Carolina	774	1.9 (1.0–3.5)	27.0 (21.3–33.7)	53.9 (45.8–61.8)	15.4 (10.4–22.4)
Oklahoma	197	3.8 (1.4–9.6)	23.6 (17.5–31.0)	54.2 (45.9–62.3)	15.4 (9.8–23.3)
Pennsylvania	340	1.7 (0.8–3.7)	28.9 (23.5–35.1)	56.8 (51.1–62.3)	12.2 (8.7–16.8)
Rhode Island	413	3.7 (1.6–8.1)	31.1 (26.0–36.7)	49.7 (43.0–56.3)	13.4 (9.3–19.1)
South Carolina	156	6.5 (1.7–22.3)	32.7 (25.0–41.4)	44.6 (38.5–50.8)	14.2 (10.5–18.9)
Vermont	3,028	8.4 (7.5–9.5)	47.0 (45.2–48.8)	36.3 (34.6–38.0)	7.3 (6.4–8.3)
West Virginia	278	3.1 (1.3–7.0)	41.7 (34.2–49.6)	41.0 (33.4–49.2)	11.3 (8.5–15.0)

Abbreviations: LARC = long-acting, reversible contraception; CI = confidence interval.
* Had sexual intercourse with at least one person during the 3 months before the survey.
† Highly effective, reversible contraceptive methods or LARC include intrauterine devices (e.g., Mirena or ParaGard) and implants (e.g., Implanon or Nexplanon).
§ Moderately effective contraceptive methods include oral contraceptive pills or a hormone injection (e.g., Depo-Provera), a transdermal patch (e.g., OrthoEvra), or a vaginal birth control ring (e.g., NuvaRing).
¶ Less effective contraceptive methods include condoms to prevent pregnancy, withdrawal, or some other method.

consent, private insurers often follow state laws, which vary by jurisdiction, potentially limiting access (*14*). To improve access and availability to the full range of contraception, a number of state-level and jurisdictional-level strategies exist and could be adopted by state and local agencies (Box).

The findings in this report are subject to at least five limitations. First, information on contraceptive use was self-reported and might be subject to recall or social desirability bias, and response rates varied by state and surveillance system.¶¶¶¶ Second, consistent and correct use of contraception affects effectiveness rates, and this was not measured. Third, population estimates are generalizable only to specific populations for which data are collected; for example, estimates among sexually active female high school students are not generalizable to adolescents who do not attend school. Fourth, the current contraceptive use profile in states might have changed since the data were collected. Finally, only 39 of the 41 states had data from at least one surveillance system, highlighting the need for ongoing collection of state-level data on contraceptive use (*3*).*****

State-level strategies for increasing access to the full range of FDA-approved contraceptive methods and related services can reduce unintended pregnancies among women, including women who might be exposed to Zika virus. CDC supports states in 1) implementing vector control strategies;

¶¶¶¶ BRFSS response rates vary by state (https://www.cdc.gov/brfss/annual_data/2013/pdf/2013_dqr.pdf). PRAMS/MIHA response rates vary by state, but must meet the minimum 55% response threshold to be included; however, the typical minimum response threshold for PRAMS/MIHA is 65% (http://www.cdc.gov/prams/methodology.htm). YRBS response rates vary by state (http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6201a1.htm).

***** The 41 states in the potential range of Zika-carrying mosquitoes are as follows: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, and Wisconsin.

BOX. State and jurisdictional-level strategies for increasing access and availability of long-acting reversible contraception (LARC) by state and local agencies, health systems, and providers

Facilitate partnership among private and public insurers, device manufacturers, and state agencies
- Improve acquisition management
- Streamline service provision
- Increase efficiency in product purchase
- Reduce per capita costs

Reimburse providers for the full range of contraceptive services
- Screen for pregnancy intention
- Provide client-centered contraception counseling
- Fund full cost of device insertion, removal, and replacement
- Compensate for device reinsertion of LARC and follow-up

Remove logistic and administrative barriers for contraceptive services and supplies*
- Eliminate policies requiring pre-approval
- Decrease step therapy restriction or required use of generic drugs before brand-name medication
- Stock highly effective contraceptive devices in all hospitals and clinics

Train health care providers on current insertion and removal techniques for LARC
- Support use of CDC's evidence-based contraceptive guidance†
- Provide quality family planning services§
- Increase awareness on use of LARC for most clients of all ages

Support youth-friendly reproductive health services
- Educate health care providers on confidentiality concerns of female adolescents/minors
- Withhold automated distribution of explanation of benefits to the primary payer
- Offer extended and weekend hours
- Provide teen-focused, culturally appropriate materials during health care visits¶,**

Engage smaller or rural facilities including community health care centers††
- Ensure adequate provider training and supply of LARC
- Partner with larger facilities to implement contraceptive services

BOX. (*Continued*) State and jurisdictional-level strategies for increasing access and availability of long-acting reversible contraception (LARC) by state and local agencies, health systems, and providers

Assess client satisfaction with service provision§§ and increase consumer awareness
- Implement public/private campaigns
- Provide comprehensive sexual health education in secondary schools

* Auerbach J. The 3 buckets of prevention. J Public Health Manag Pract 2016;22:215–8.
† Curtis KM, Jatloui TC, Tepper NK. U.S. selected practice recommendations for contraceptive use, 2016. MMWR Recomm Rep 2016;65(No. RR-4).
§ Gavin L, Moskosky S, Carter M, et al. Providing quality family planning services: recommendations of CDC and the U.S. Office of Population Affairs. MMWR Recomm Rep 2014;63(No. RR-4).
¶ Hathaway M, Torres L, Vollett-Krech J, Wohltjen H. Increasing LARC utilization: any woman, any place, any time. Clin Obstet Gynecol 2014;57:718–30.
** CDC. Communitywide teen pregnancy prevention initiatives. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. http://www.cdc.gov/teenpregnancy/prevent-teen-pregnancy/
†† Goldberg DG, Wood SF, Johnson K, et al. The organization and delivery of family planning services in community health centers. Womens Health Issues 2015;25:202–8.
§§ Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. Health Aff (Millwood) 2008;27:759–69.

2) identifying, diagnosing, and clinically managing infection and exposure among pregnant women; and 3) increasing information about effective contraception to avoid unintended pregnancy (*15*). Prevention efforts for all women and men of reproductive age include targeted education about Zika virus and its transmission, condom use to avoid sexual transmission to pregnant women, and contraceptive counseling for women who want to delay or avoid pregnancy (*15*). Because contraception is the primary means to prevent unintended pregnancy for women at risk for Zika virus infection, sexually active nonpregnant women of reproductive age and their sex partners need to have access to all approved contraceptive methods, and these methods need to be readily available and accessible.

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Summary

What is already known on this topic?

Zika virus is transmitted through the bite of an *Aedes* species mosquito, sex with an infected partner, or from a pregnant woman to her fetus. Zika virus infection during pregnancy is a cause of congenital microcephaly and other severe fetal brain defects. It has also been associated with eye defects, hearing loss, and impaired growth. Nearly half of all pregnancies in the United States are unintended. Among nonpermanent contraceptive methods, long-acting reversible contraception (LARC) is the most effective contraceptive option for preventing unintended pregnancy.

What is added by this report?

State-based estimates of contraception use are provided for nonpregnant and postpartum women at risk for unintended pregnancy and sexually active female high school students. Among these populations, use of moderate and less effective contraception was most common; use of no contraceptive method and use of LARC varied by state, age group, and race/ethnicity.

What are the implications for public health practice?

State and local strategies are needed to increase access to contraceptive methods and related services, reduce the risk for unintended pregnancy, and minimize the number of pregnancies affected by Zika infection. Potentially effective strategies include addressing policies on high device costs and provider reimbursement, comprehensive provider training on insertion and removal of LARC, provision of youth-friendly services, support to resource-challenged jurisdictions, client-centered counseling and assessment of patient satisfaction, and increased consumer awareness of the full range of contraceptive methods to delay or avoid pregnancy.

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Notes from the Field

Fatal Infection Associated with Equine Exposure — King County, Washington, 2016

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On March 17, 2016, Public Health—Seattle & King County in Washington was notified of two persons who received a diagnosis of *Streptococcus equi* subspecies *zooepidemicus* (*S. zooepidemicus*) infections. *S. zooepidemicus* is a zoonotic pathogen that rarely causes human illness and is usually associated with consuming unpasteurized dairy products or with direct horse contact (*1*). In horses, *S. zooepidemicus* is a commensal bacterium that can cause respiratory, wound, and uterine infections (*2*). The health department investigated to determine the magnitude of the outbreak, identify risk factors, and offer recommendations.

Patient A, a previously healthy woman aged 37 years, operated a horse boarding and riding facility in King County, Washington. Patient A fed, groomed, and exercised the facility's six horses and cleaned the stalls daily. During the week of February 21, 2016, patient A developed mild pharyngitis and cough. During the week of February 21, horse A developed mucopurulent ocular and nasal discharge and lethargy. On February 29, patient A began administering 10 days of sulfa-based antibiotics to horse A, which recovered without incident.

Patient B, a previously healthy woman aged 71 years and the mother of patient A, developed symptoms consistent with an upper respiratory infection during the week of February 21 while visiting patient A and living in the same household. On March 2, she developed vomiting and diarrhea. On March 3, she was found unconscious and transported to a hospital, where she died that day. Patient B had close contact (i.e., riding, petting, and walking) with horse A on at least February 25 and February 29.

Culture results of nasal swabs collected on March 10 from horse A and two other horses that appeared well were positive for *S. zooepidemicus*. Patient A did not report consumption of unpasteurized dairy products or exposure to other animals, apart from one healthy cat, during the preceding 2 months. A throat culture from patient A obtained March 10 and blood cultures from patient B grew *S. zooepidemicus* isolates indistinguishable by pulsed-field gel electrophoresis from isolates cultured from horse A and a second horse at the facility. *S. zooepidemicus* cultured from a third horse did not match other isolates.

The epidemiologic and laboratory evidence from this investigation linked a fatal *S. zooepidemicus* infection to close contact with an ill horse. Patient B might have been at increased risk for invasive disease by *S. zooepidemicus* because of her age and her possible antecedent upper respiratory infection. Because patient A specifically sought health care and a throat culture as a result of patient B's death, determining whether the *S. zooepidemicus* infection preceded or followed her mild illness approximately 2 weeks earlier was not possible.

Although *S. zooepidemicus* is a rare zoonotic pathogen in humans, older persons might be at increased risk for a fatal outcome from this infection; in 32 reported cases, the median age was 61 years (range = <1 to 83 years) with 7 deaths (case-fatality rate = 22%) (*1*). Consistently practicing thorough hand washing with soap and water after contact with horses and other animals or areas where animals are housed is recommended (*3*). This outbreak highlights the need for more research regarding risk factors for zoonotic transmission and spectrum of human illness associated with *S. zooepidemicus*.

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Erratum

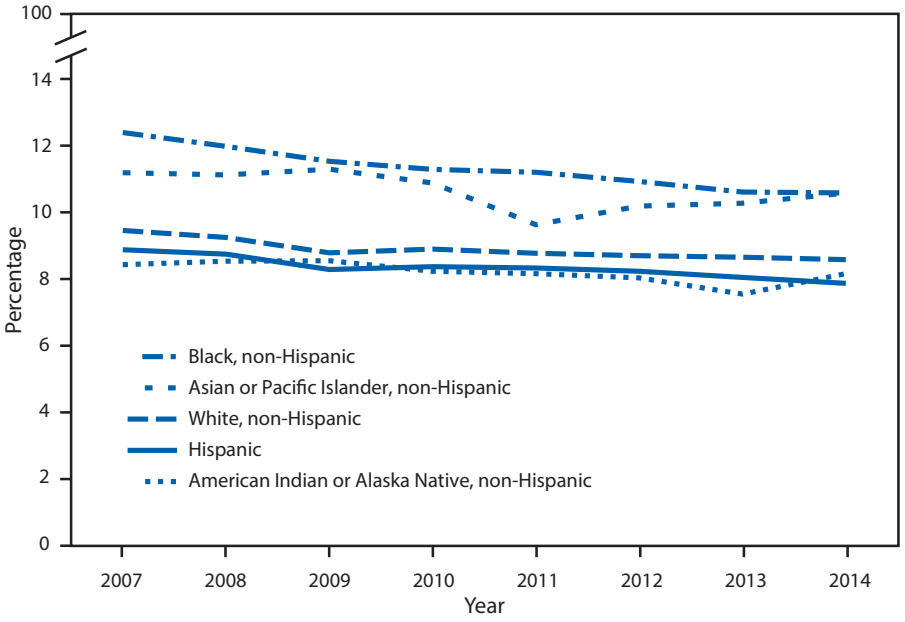
Vol. 65, No. 26

In the report, "Notes from The Field: Ebola Virus Disease Cluster — Northern Sierra Leone, January 2016," the name of a member of The Interagency Investigation Team was incorrect and should have read as follows: "**Matthew Cotten**, PhD, Wellcome Trust Sanger Institute, United Kingdom."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Preterm Births† Among Teens Aged 15–19 Years, by Race/Ethnicity — National Vital Statistics System, United States, 2007–2014§



* Percentages are calculated for singleton births only.
† Births occurring <37 weeks gestation are considered preterm. Preterm births are based on the obstetric estimate of gestational age.
§ The obstetric estimate of gestational age became available for national estimates in 2007.

During 2007–2014, the percentage of births among teens aged 15–19 years that were preterm declined for each racial/ethnic group, except for non-Hispanic Asian or Pacific Islander teens, where the change was not significant. In 2014, the percentage of births that were preterm was higher among non-Hispanic black and non-Hispanic Asian or Pacific Islander teens (10.6% for both) than non-Hispanic white (8.6%), non-Hispanic American Indian or Alaska Native (8.2%), and Hispanic (7.9%) teens.

Source: National Vital Statistics System Birth Data. http://www.cdc.gov/nchs/births.htm.

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