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National HIV Testing Day — June 27, 2017

National HIV Testing Day, June 27, highlights the importance of testing in detecting, treating, and preventing human immunodeficiency virus (HIV) infection. Awareness of HIV infection through HIV testing is the first step to prevention, health care, and social services that improve quality of life and length of survival (*1*).

CDC's National HIV Behavioral Surveillance (NHBS) monitors behaviors among populations at risk for acquiring or transmitting HIV infection. Recent NHBS data indicate that persons at risk for HIV infection who had ever received testing for HIV are testing at shorter intervals than in the past (*2*). The average interval in months between two successive HIV tests decreased from 21.1 in 2010 to 19.9 in 2013 among heterosexuals at increased risk for HIV, from 10.5 in 2009 to 7.7 in 2014 among men who have sex with men, and from 14.4 in 2009 to 11.5 in 2015 among persons who inject drugs.

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

References

1. CDC. HIV diagnosis, care, and treatment among persons living with HIV—United States, 2011. MMWR Morb Mortal Wkly Rep 2014;63:1113–7.
2. An Q, Song R, Finlayson TJ, Wejnert C, Paz-Bailey G; NHBS Study Group. Estimated HIV inter-test interval among people at high risk for HIV infection in the US. Am J Prev Med 2017. http://www.sciencedirect.com/science/article/pii/S0749379717301435

HIV Testing, Linkage to HIV Medical Care, and Interviews for Partner Services Among Youths — 61 Health Department Jurisdictions, United States, Puerto Rico, and the U.S. Virgin Islands, 2015

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Identifying persons living with human immunodeficiency virus (HIV) who are unaware of their infection, linking them to HIV medical care, and reducing health disparities are important national goals (*1*). Of the 8,841 teens and young adults aged 13–24 years (collectively referred to as youths in this report) who received a diagnosis of HIV in 2014, 70% were young men who have sex with men (MSM) (*2*). In the same year, an estimated 52% of young MSM living with HIV were unaware of their infection compared with 15% among all persons living with HIV (*3*). An average of 22% of high school students who have had sexual intercourse and 33% of young adults (persons aged 18–24 years) reported ever receiving an HIV test (*4*). CDC recommends screening all persons aged 13–64 years, with annual rescreening for persons at high risk

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for HIV infection (5). Analysis of CDC-funded program data for youths submitted by 61 health departments in 2015 revealed that young MSM, who accounted for 83% of new diagnoses among all youths in non–health care facilities, received 28% of HIV tests.* The 2020 national goal is to link at least 85% of HIV-positive persons to HIV medical care within 30 days of diagnosis. In this analysis, 66% of youths who received positive test results for HIV infection were linked to care within 90 days of diagnosis. Increasing the number of youths at risk for HIV infection who are tested for HIV on a regular basis and ensuring that youths who receive positive test results for HIV are rapidly linked to and retained in appropriate medical care, including early initiation of antiretroviral therapy, are essential steps for reducing HIV infection in this vulnerable population.

In 2015, CDC funded 61 state and local health departments and 123 community-based organizations (CBOs)† to provide HIV testing and related services in the United States, Puerto Rico, and the U.S. Virgin Islands. Health departments submitted deidentified program data about services provided by both health departments and CBOs, through a secure, online, CDC-supported system. Data from 2015 analyzed for this report include CDC-funded HIV tests,§ new positive diagnoses, linkage of persons with newly or previously identified HIV to medical care within 90 days of diagnosis,¶ and interviews for partner services** among youths. Data were stratified by the following demographic characteristics: age group, race/ethnicity, gender, test setting, census region, and health department jurisdiction's HIV prevalence.††

* Non–health care facilities are settings where HIV testing is performed using a targeted testing strategy rather than a routine screening strategy. Examples of non–health care facilities include HIV testing sites and community settings.

† CDC-funded partners include health departments in 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and eight directly funded city/county health departments (Baltimore, Maryland; Chicago, Illinois; Fulton County, Georgia; Houston, Texas; Los Angeles County, California; New York City, New York; Philadelphia, Pennsylvania; and San Francisco, California) and 123 directly funded community-based organizations. Community-based organizations report their National HIV Prevention Program Monitoring and Evaluation HIV testing data to their jurisdiction's health department who then submit them to CDC.

§ An HIV test is defined as the performance of one or more HIV tests to determine a person's HIV infection status. A person might be tested once (e.g., one rapid test or one conventional test) or multiple times (e.g., one rapid test followed by one conventional test to confirm a preliminary HIV-positive test result).

¶ Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of their HIV test date.

** "Partner services" is a process through which HIV infected persons are interviewed to elicit information about their partners, who can then be confidentially notified of their possible exposure or potential risk and offered services that can protect the health of partners and prevent HIV transmission to others.

†† Jurisdictions are grouped by HIV prevalence as determined by the number of persons living with diagnosed HIV infection in 2013: high: ≥20,000; medium: 4,000–19,999; medium-low/low: ≤3,999. High prevalence jurisdictions include the following: California, Los Angeles, San Francisco; Florida; Georgia, Fulton County (Atlanta); Chicago, Illinois; Maryland, Baltimore; New Jersey; New York, New York City; North Carolina; Pennsylvania, Philadelphia; Texas, Houston; and Virginia. Medium prevalence jurisdictions include Alabama; Arizona; Arkansas; Colorado; Connecticut; District of Columbia; Indiana; Kentucky; Louisiana; Massachusetts; Michigan; Minnesota; Mississippi; Missouri; Nevada; Ohio; Oklahoma; Oregon; Puerto Rico; South Carolina; Tennessee; Washington; and Wisconsin. Medium-low/low prevalence jurisdictions include Alaska; Delaware; Hawaii; Idaho; Iowa; Kansas; Maine; Montana; Nebraska; New Hampshire; New Mexico; Rhode Island; South Dakota; U.S. Virgin Islands; Utah; Vermont; West Virginia; and Wyoming.

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Tests performed in non–health care facilities were stratified by target population.[§§] Multivariate log-binomial regression was used to assess the association between demographic characteristics and newly diagnosed HIV infections, linkage to HIV medical care, and interviews for partner services. To analyze linkage to HIV medical care among previously diagnosed HIV-positive youths, modified Poisson regression analysis was used, and the association between the target population and newly diagnosed HIV infections in non–health care facilities was assessed using univariate log-binomial regression.

Among 3,026,074 CDC-funded tests provided in 2015, a total of 838,342 (28%) were provided to youths. Among youths, the highest percentages of tests were provided to persons who were aged 20–24 years (74%), female (55%), and black (50%) and were provided in health care facilities (76%), in the South (58%), and in medium and high prevalence jurisdictions (97%). The highest percentages of tests performed in non–health care facilities were provided to young heterosexual females (36%), young heterosexual males (30%), and young MSM (28%) (Table 1). Findings indicated that compared with youths aged 20–24 years, those aged 13–19 years were less likely to have newly diagnosed infection (adjusted prevalence ratio [aPR] = 0.51). White youths (0.22%; aPR = 0.45), Hispanic/Latino youths (0.39%; aPR = 0.70), and youths of other racial/ethnic groups[¶¶] (0.32%; aPR = 0.50) were less likely to have newly diagnosed infection than were black youths (0.44%). Tests in health care facilities were less likely to yield new diagnoses than tests performed in non–health care facilities (aPR = 0.60) (Table 1). Compared with tests performed in the South, tests performed in the Northeast were less likely to yield new diagnoses (aPR = 0.73), whereas tests performed in the West were more likely to yield new diagnoses (aPR = 1.20). Tests performed in medium and medium-low/low prevalence jurisdictions were less likely to yield new diagnoses (aPR = 0.75 and aPR = 0.62, respectively) than tests performed in high prevalence jurisdictions (Table 1). Findings in non–health care facilities indicated that compared with young MSM, transgender youths, youths who inject drugs, young heterosexual males, and young heterosexual females were all less likely to receive a new diagnosis of HIV infection (aPRs = 0.64, 0.19, 0.08, and 0.05, respectively) (Table 1).

Among 2,973 youths who received a new diagnosis of HIV infection, 1,955 (66%) were linked to HIV medical care within 90 days of diagnosis, and 1,871 (63%) were interviewed for partner services (Table 2). Compared with the South (64%), the prevalence of being linked to HIV medical care within 90 days of diagnosis was lower in the Midwest (49%; aPR = 0.81) but higher in the Northeast (78%; aPR = 1.18), West (77%; aPR = 1.16), and U.S. dependent areas[***] (86%; aPR = 1.50) (Table 2). The prevalence of being interviewed for partner services in the South was 62%; compared with the South, this prevalence was higher in the West (70%; aPR = 1.09) and the U.S. dependent areas (84%; aPR = 1.34) (Table 2).

Among 4,884 HIV infections identified among youths, 1,911 (39%) had been previously diagnosed, and 1,749 (92%) of these youths with previously diagnosed infection were not in HIV medical care at the time of testing (Table 1) (Table 3). Among the 1,749 youths with previously diagnosed infection who were not in HIV medical care, 66% were linked to care within 90 days of diagnosis. Compared with the South, where the prevalence of being linked to care was 61%, the prevalence was higher in the Northeast (77%; aPR = 1.30), Midwest (74%; aPR = 1.21), and the West (83%; aPR = 1.33).

Discussion

Among youths living with HIV infection, testing and partner services are important strategies for diagnosis and prompt linkage to medical care so they can achieve viral suppression and reduce their risk for transmission to others. A national surveillance study determined that 92% of new infections in 2009 were acquired from persons with HIV who were not in medical care, underscoring the importance of early diagnosis and ongoing care and treatment (*6*). Given that approximately half of young MSM living with HIV are unaware of their status, and that the testing rates among youths are relatively low, improving the number of youths who are tested is of high importance (*3*,*4*). Including HIV testing as part of routine medical care for youths is key to increasing early diagnosis, and a health care provider's testing recommendation is the most important predictor of testing among adolescents at risk for HIV infection (*7*). It is especially important to test young MSM because they are most disproportionately affected by HIV. In this analysis, young MSM, who accounted for 83% of new HIV infection diagnoses among all youths in non–health care facilities, received 28% of the tests. Expanding testing in places where youths might interact with the health care system, and providing youth- and lesbian/gay/bisexual/transgender-friendly services, might increase testing among youths, especially young MSM (*8*).

By 2020, national goals call for linking 85% of persons who received a new diagnosis of HIV infection to medical care within 30 days of diagnosis (*1*). Findings from this report indicate that approximately two thirds (66%) of youths who received a diagnosis of HIV infection in 2015 through

[§§] Target population data are available only for tests performed in non–health care facilities and not for tests performed in health care facilities.

[¶¶] Other races/ethnicities include Asian, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander.

[***] For this report, U.S. dependent areas include only Puerto Rico and the U.S. Virgin Islands.

TABLE 1. HIV tests and newly diagnosed HIV infections among youths,* by selected characteristics — United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	No. all HIV tests†	HIV tests† among youths		No. all newly diagnosed HIV infections§	Newly diagnosed HIV infections§ among youths			
		No. (%)	% of subgroup		No. (%)	% of subgroup	% Positive	aPR (95% CI)
Age group (yrs)								
13–19	221,338	—	26.4	415	—	14.0	0.19	0.51 (0.45–0.56)¶
20–24	617,004	—	73.6	2,558	—	86.0	0.41	Reference
Gender**								
Male	1,535,214	374,757 (24.4)	45.0	10,531	2,661 (25.3)	89.6	0.71	Reference
Female	1,457,341	453,198 (31.1)	54.5	1,801	256 (14.2)	8.6	0.06	0.09 (0.08–0.10)¶
Transgender	13,097	4,299 (32.8)	0.5	187	52 (27.8)	1.8	1.21	1.66 (1.26–2.18)¶
Race/Ethnicity**								
White	785,623	201,135 (25.6)	25.6	2,657	440 (16.6)	15.1	0.22	0.45 (0.41–0.50)¶
Black or African American	1,304,956	396,327 (30.4)	50.4	5,843	1,727 (29.6)	59.3	0.44	Reference
Hispanic or Latino	647,773	159,865 (24.7)	20.3	3,253	626 (19.2)	21.5	0.39	0.70 (0.63–0.77)¶
Other††	87,176	21,081 (24.2)	2.7	335	67 (20.0)	2.3	0.32	0.50 (0.39–0.64)¶
Multiple races	21,015	8,510 (40.5)	1.1	124	51 (41.1)	1.8	0.60	0.99 (0.75–1.31)
Test setting**								
Health care facility	2,313,742	633,088 (27.4)	75.8	7,623	1,665 (21.8)	56.3	0.26	0.60 (0.56–0.65)¶
Non–health care facility	703,890	202,181 (28.7)	24.2	4,860	1292 (26.6)	43.7	0.64	Reference
U.S. Census region								
Northeast	480,665	125,699 (26.2)	15.0	1,888	373 (19.7)	12.6	0.30	0.73 (0.65–82)¶
Midwest	419,516	126,792 (30.2)	15.1	1,549	439 (28.3)	14.8	0.35	1.07 (0.96–1.20)
South	1,689,548	488,561 (29.0)	58.3	6,296	1687 (26.8)	56.7	0.35	Reference
West	391,353	84,675 (21.7)	10.1	2,564	431 (16.8)	14.5	0.51	1.20 (1.07–1.35)§§
U.S. dependent areas	44,992	12,615 (28.0)	1.5	250	43 (17.2)	1.5	0.34	1.31 (0.95–1.80)
HIV prevalence								
High	1,784,092	460,162 (25.8)	54.9	8,421	1,923 (22.8)	64.7	0.42	Reference
Medium	1,150,815	350,075 (30.4)	41.8	3,830	981 (25.6)	33.0	0.28	0.75 (0.69–0.82)¶
Medium-low/Low	91,167	28105 (30.8)	3.4	296	69 (23.3)	2.3	0.25	0.62 (0.49–0.80)¶
Overall total	3,026,074	838,342 (27.7)	100.0	12,547	2,973 (23.7)	100.0	0.35	—
Target population (non–health care facilities only)¶¶								
Men who have sex with men	153,842	42,184 (27.4)	28.2	2,891	883 (30.5)	82.8	2.09	Reference
Transgender persons	5,445	1,860 (34.2)	1.2	98	25 (25.5)	2.3	1.34	0.64 (0.43–0.9.5)***
Persons who inject drugs	37,212	6,425 (17.3)	4.3	254	26 (10.2)	2.4	0.40	0.19 (0.13–0.29)¶
Heterosexual males	159,948	44,641 (27.9)	29.9	464	75 (16.2)	7.0	0.17	0.08 (0.06–0.10)¶
Heterosexual females	154,598	54,323 (35.1)	36.4	312	57 (18.3)	5.3	0.10	0.05 (0.04–0.07)¶
Total in non–health care facilities	703,890	202,181 (28.7)	100.0	4,860	1,292 (26.6)	100.0	0.64	—

Abbreviations: aPR = adjusted prevalence ratio; HIV = human immunodeficiency virus.

* Youths are defined as teens and young adults aged 13–24 years.

† Valid HIV tests were defined as tests for which a test result (i.e., positive or negative) was known. Analyses excluded discordant and indeterminate results.

§ Included are persons who tested HIV-positive and did not report a previous positive test result, calculated using HIV surveillance verification (if available) or a person's self-reported previous HIV status.

¶ Significant at p<0.001.

** Missing/invalid data were excluded. In the category "HIV tests among youths," 6,088 (0.73%) records were excluded from gender, 51,424 (6.13%) from race/ethnicity, and 3,073 (0.37%) from test setting. In the category "newly diagnosed HIV infection among youths," four (0.13%) were excluded from gender, 62 (2.09%) from race/ethnicity, and 16 (0.54%) from test setting.

†† Includes Asian, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander.

§§ Significant at p<0.01.

¶¶ Target population data are available only for tests performed in non–health care facilities and not for tests performed in health care facilities. Therefore, these data come from non–health care facilities only. Records that specified other target population and those with missing/invalid data were excluded. In the category "HIV tests among youths," 33,703 (16.67%) records that specified other target population and 19,045 (9.42%) records with missing/invalid data were excluded. In the category "newly diagnosed HIV infection among youths," 208 (16.10%) records that specified other target population and 18 (1.39%) records with missing/invalid data were excluded.

*** Significant at p<0.05.

TABLE 2. Linkage to HIV medical care and interviews for partner services among newly diagnosed HIV-positive youths,* by selected characteristics — United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	No. newly diagnosed HIV infections,† (% of total)	Linked to HIV medical care within 90 days of diagnosis§			Interviewed for partner services¶		
		No. (% of subgroup)	aPR (95% CI)	No. missing linkage info. (%)	No (%)	aPR (95% CI)	No. missing linkage info. (%)
Age group (yrs)							
13–19	415 (14.0)	263 (63.4)	0.95 (0.88–1.03)	121 (29.2)	258 (62.2)	0.98 (0.90–1.06)	88 (21.2)
20–24	2,558 (86.0)	1,692 (66.1)	Reference	582 (22.8)	1,613 (63.1)	Reference	475 (18.6)
Gender**							
Male	2,661 (86.9)	1,758 (66.1)	Reference	624 (23.5)	1,693 (63.6)	Reference	500 (18.8)
Female	256 (8.6)	163 (63.7)	1.00 (0.91–1.10)	68 (26.6)	147 (57.4)	0.92 (0.83–1.03)	47 (18.4)
Transgender	52 (1.8)	31 (59.6)	0.89 (0.72–1.10)	11 (21.2)	28 (53.9)	0.86 (0.67–1.11)	16 (30.8)
Race/Ethnicity**							
White	440 (15.1)	302 (68.6)	1.08 (0.99–1.16)	93 (21.1)	275 (62.5)	0.97 (0.88–1.05)	74 (16.8)
Black or African American	1,727 (59.3)	1,085 (62.8)	Reference	437 (25.3)	1,074 (62.2)	Reference	355 (20.6)
Hispanic or Latino	626 (21.5)	460 (73.5)	1.04 (0.97–1.10)	127 (20.3)	424 (67.7)	1.00 (0.94–1.08)	89 (14.2)
Other††	67 (2.3)	52 (77.6)	1.11 (0.98–1.26)	9 (13.4)	40 (59.7)	0.89 (0.73–1.08)	13 (19.4)
Multiple races	51 (1.8)	32 (62.7)	0.96 (0.78–1.18)	15 (29.4)	29 (56.9)	0.88 (0.70–1.11)	12 (23.5)
Test setting**							
Health care facility	1,665 (56.3)	1,093 (65.6)	1.00 (0.95–1.05)	396 (23.8)	1,052 (63.2)	1.01 (0.95–1.07)	302 (18.1)
Non–health care facility	1,292 (43.7)	853 (66.0)	Reference	304 (23.5)	807 (62.5)	Reference	260 (20.1)
U.S. Census region							
Northeast	373 (12.5)	292 (78.3)	1.18 (1.11–1.27)§§	49 (13.1)	245 (65.7)	1.05 (0.97–1.15)	81 (21.7)
Midwest	439 (14.8)	216 (49.2)	0.81 (0.73–0.90)§§	157 (35.8)	240 (54.7)	0.85 (0.77–0.94)	68 (15.5)
South	1,687 (56.7)	1,077 (63.8)	Reference	423 (25.1)	1,049 (62.2)	Reference	383 (22.7)
West	431 14.5)	333 (77.3)	1.16 (1.09–1.25)§§	68 1(5.8)	301 (69.8)	1.09 (1.01–1.18)¶¶	26 (6.0)
U.S. dependent areas	43 (1.4)	37 (86.0)	1.50 (1.29–1.74)§§	6 14.0)	36 (83.7)	1.34 1.14–1.58)§§	5 (11.6)
HIV prevalence							
High	1,923 (64.7)	1,48 (70.1)	Reference	388 20.2)	1,217 (63.3)	Reference	353 (18.4)
Medium	981 (33.0)	545 (55.6)	0.83 (0.78–0.89)§§	311 31.7)	590 (60.1)	0.99 0.92–1.06)	208 (21.2)
Medium-low/Low	69 (2.3)	62 (89.9)	1.30 (1.18–1.44)§§	4 5.8)	64 (92.8)	1.64 1.49–1.81)§§	2 (2.9)
Overall total	**2,973**	**1,955 (65.8)**	—	**703 23.7)**	**1,871 (62.9)**	—	**563 (18.9)**

Abbreviations: aPR = adjusted prevalence ratio; HIV = human immunodeficiency virus.

* Youths are defined as teens and young adults aged 13–24 years.

† Includes persons who tested HIV-positive during the current test and were not found to be previously reported in the health department jurisdiction's HIV surveillance system or self-reported not having a previous HIV-positive test result if surveillance system verification was not available.

§ Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of their diagnosis.

¶ "Partner services" is a process through which HIV-infected persons are interviewed to elicit information about their partners, who can then be confidentially notified of their possible exposure or potential risk and offered services that can protect the health of partners and prevent HIV transmission to others.

** Missing or invalid data were excluded. For the category "linked to HIV medical care," three records were excluded from gender, 24 from race/ethnicity, and nine from test setting. For the category "interviewed for partner services," three records were excluded from gender, 29 from race/ethnicity, and 12 from test setting.

†† Includes Asian, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander.

§§ Significant at p<0.001.

¶¶ Significant at p<0.05.

CDC-funded HIV testing programs were linked to care within 90 days of diagnosis. Among youths who received a new HIV infection diagnosis, 63% were interviewed for partner services. The greatest need for improvement appears to be in the South and the Midwest, where rates of linkage and interviews for partner services were relatively low. These low rates are particularly concerning for the South because in 2015, approximately 52% of new diagnoses of HIV infection in the United States occurred in the region (*9*).

In this analysis, 39% of youths who received an HIV-positive test result had already received a diagnosis of HIV infection in the past, and 92% of those persons were not in HIV medical care at the time of the test. Youths who have previously received a diagnosis of HIV infection and are willing to receive a test present an important HIV treatment opportunity. Youths might face multiple barriers to treatment, such as consent and confidentiality, inability to pay for services, housing instability, stigma, lack of transportation, and mental health and substance use, which might need to be addressed for successful linkage and retention to care (*8*).

The findings in this report are subject to at least three limitations. First, findings describe CDC-funded HIV tests only and are not generalizable to all youths in the United States. Second, linkage data include records with missing or invalid data in

TABLE 3. Linkage to HIV medical care among previously diagnosed HIV-positive youths,* by selected characteristics, United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	No. previously diagnosed HIV infections†	No. not in HIV medical care at time of current HIV test (%)	Previously diagnosed HIV-positive youths not in HIV medical care at time of this test who were then linked to care§		
			No. (%)	aPR (95% CI)	No. missing linkage info (%)
Age group (yrs)					
13–19	216	197 (91.2)	134 (68.0)	1.02 (0.93–1.13)	33 (16.8)
20–24	1,695	1,552 (91.6)	1,023 (65.9)	Reference	350 (22.6)
Gender¶					
Male	1,615	1,474 (91.3)	986 (66.9)	Reference	311 (21.1)
Female	256	239 (93.4)	149 (62.3)	0.94 (0.85–1.05)	62 (25.9)
Transgender	31	27 (87.1)	19 (70.3)	1.02 (0.80–1.30)	7 (25.9)
Race/Ethnicity¶					
White	221	213 (96.4)	156 (73.2)	1.09 (0.99–1.20)	40 (18.8)
Black or African American	1,328	1,192 (89.8)	775 (65.0)	Reference	268 (22.5)
Hispanic or Latino	243	232 (95.5)	167 (72.0)	1.06 (0.96–1.17)	43 (18.5)
Other**	26	26 (100.0)	20 (76.9)	1.07 (0.85–1.33)	3 (11.5)
Multiple races	15	14 (93.3)	7 (50.0)	0.72 (0.43–1.20)	5 (35.7)
Test setting¶					
Health care facility	1,433	1,304 (91.0)	868 (66.6)	1.01 (0.93–1.10)	280 (21.5)
Non-health care facility	470	438 (93.2)	287 (65.5)	Reference	100 (22.8)
U.S. Census region					
Northeast	129	112 (86.8)	86 (76.8)	1.30 (1.16–1.46)††	19 (17.0)
Midwest	325	276 (84.9)	203 (73.6)	1.21 (1.11–1.33)††	42 (15.2)
South	1,294	1,210 (93.5)	742 (61.3)	Reference	306 (25.3)
West	156	144 (92.3)	120 (83.3)	1.33 (1.20–1.47)††	16 (11.1)
U.S. dependent areas	7	7 (100.0)	6 (85.7)	1.29 (0.93–1.78)	0 (0.0)
HIV prevalence					
High	1043	942 (90.3)	629 (66.8)	Reference	188 (20.0)
Medium	854	797 (93.3)	521 (65.4)	1.07 (1.00–1.15)	193 (24.2)
Medium-low/Low	14	10 (71.4)	7 (70.0)	0.95 (0.66–1.38)	2 (20.0)
Overall total	**1,911**	**1,749 (91.5)**	**1,157 (66.2)**	—	**383 (21.9)**

Abbreviations: aPR = adjusted prevalence ratio; HIV = human immunodeficiency virus.

* Youths are defined as teens and young adults aged 13-24 years.

† Previously diagnosed HIV infections include those who tested HIV-positive during the current test and were found to be previously reported in the health department's HIV surveillance system or self-reported having a previous HIV-positive test result if the surveillance system verification is not available.

§ Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of receiving their diagnosis.

¶ Missing or invalid data were excluded. In the category "previously diagnosed HIV infections," nine records were excluded from gender, 78 from race/ethnicity, and eight from test setting. In the category "linked to care," three records were excluded from gender, 32 from race/ethnicity, and two from test setting.

** Includes Asian, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander.

†† Significant at p<0.001.

the denominator, and therefore probably underestimate the percentage of persons linked to care. Finally, when surveillance data are unavailable to verify prior HIV status, the number of new positive results might be overestimated if clients inaccurately report a previous negative HIV status.

Increasing the number of HIV tests among youths at risk for HIV and increasing regular retesting among these youths is essential for reducing HIV infection in this vulnerable population. This could be accomplished through a combined strategy of routine HIV testing among youths, especially young men, in health care settings, and targeted testing in places where youths at risk for HIV infection congregate. CDC currently funds 120 CBOs to provide targeted testing to the populations most at risk for HIV infection; 30 of these CBOs specifically serve young MSM and transgender persons of color (*10*). Additional measures are needed to encourage health care providers to include HIV testing as a routine part of health care for youths. Schools can also play an important role in facilitating access to HIV testing for school-aged youth. Toward this end, CDC works with 18 state education agencies and 17 local education agencies to connect youths to community-based services, including HIV testing. Increased measures are also needed to ensure that youths who receive positive test results for HIV are rapidly linked to and retained in appropriate medical care, including early initiation of antiretroviral therapy.

Summary

What is already known about this topic?

In 2014, 70% of teens and young adults aged 13–24 (youths) who received a diagnosis of HIV infection were young men who have sex with men (MSM), 52% of whom were unaware of their infection. HIV testing rates are low among youths, with 22% of sexually active high school students and 33% of young adults aged 18–24 years reporting ever having received an HIV test.

What is added by this report?

Analysis of 2015 data on CDC-funded HIV tests and HIV prevention services from 61 health departments and 123 community-based organizations indicated that young MSM, who accounted for 83% of new diagnoses of HIV infection among all youths in non–health care facilities, received 28% of the tests in these settings. The 2020 national goal is to link at least 85% of HIV-positive persons to HIV medical care within 30 days of diagnosis; in this analysis, 66% of youths whose test results were positive for HIV were linked to care within 90 days of diagnosis. HIV disproportionately affects youths in the South, where linkage rates were among the lowest in the United States.

What are the implications for public health practice?

Increasing HIV testing among youths at risk for HIV infection is essential for reducing infections in this vulnerable population. This can be accomplished through a combined strategy of routine HIV testing of youths, especially young men, in health care settings and targeted testing in places where youths at risk for HIV infection congregate. Schools can also play an important role in facilitating access to HIV testing for school-aged youths. Increased measures are needed to ensure that youths testing positive for HIV are rapidly linked to and retained in appropriate medical care, including early initiation of antiretroviral therapy.

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Conflict of Interest

No conflicts of interest were reported.

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References

1. Office of National AIDS Policy. National HIV/AIDS strategy for the United States: updated to 2020. Washington, DC: Office of National AIDS Policy; 2015. https://obamawhitehouse.archives.gov/sites/default/files/docs/national_hiv_aids_strategy_update_2020.pdf
2. CDC. Diagnoses of HIV infection among adolescents and young adults in the United States and 6 dependent areas, 2010–2014. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-21-3.pdf
3. Singh S, Song R, Satcher Johnson A, McCray E, Hall I. HIV incidence, prevalence, and undiagnosed infections in men who have sex with men. Presented at the Conference on Retroviruses and Opportunistic Infections, Seattle, Washington; February 13–16, 2017. http://www.hivdent.org/_CROI2017/HIV%20Incidence.pdf
4. Van Handel M, Kann L, Olsen EO, Dietz P. HIV testing among US high school students and young adults. Pediatrics 2016;137:e20152700. https://doi.org/10.1542/peds.2015-2700
5. Branson BM, Handsfield HH, Lampe MA, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. MMWR Recomm Rep 2006;55(No. RR-14).
6. Skarbinski J, Rosenberg E, Paz-Bailey G, et al. Human immunodeficiency virus transmission at each step of the care continuum in the United States. JAMA Intern Med 2015;175:588–96. https://doi.org/10.1001/jamainternmed.2014.8180
7. Murphy DA, Mitchell R, Vermund SH, Futterman D; HIV/AIDS Research Network. Factors associated with HIV testing among HIV-positive and HIV-negative high-risk adolescents: the REACH Study. Pediatrics 2002;110:e36. https://doi.org/10.1542/peds.110.3.e36
8. Zanoni BC, Mayer KH. The adolescent and young adult HIV cascade of care in the United States: exaggerated health disparities. AIDS Patient Care STDS 2014;28:128–35. https://doi.org/10.1089/apc.2013.0345
9. CDC. HIV surveillance report: diagnoses of HIV infection in the United States and dependent areas, 2015. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-report-2015-vol-27.pdf
10. CDC. Funding announcement PS17–1704: comprehensive high-impact HIV prevention projects for young men of color who have sex with men and young transgender persons of color. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/hiv/funding/announcements/ps17-1704/index.html

Evaluation of Placental and Fetal Tissue Specimens for Zika Virus Infection — 50 States and District of Columbia, January–December, 2016

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Zika virus infection during pregnancy can cause congenital microcephaly and brain abnormalities (*1*), and detection of Zika virus RNA in clinical and tissue specimens can provide definitive laboratory evidence of recent Zika virus infection. Whereas duration of viremia is typically short, prolonged detection of Zika virus RNA in placental, fetal, and neonatal brain tissue has been reported and can provide key diagnostic information by confirming recent Zika virus infection (*2*). In accordance with recent guidance (*3*,*4*), CDC provides Zika virus testing of placental and fetal tissues in clinical situations where this information could add diagnostic value. This report describes the evaluation of formalin-fixed paraffin-embedded (FFPE) tissue specimens tested for Zika virus infection in 2016 and the contribution of this testing to the public health response. Among 546 live births with possible maternal Zika virus exposure, for which placental tissues were submitted by the 50 states and District of Columbia (DC), 60 (11%) were positive by Zika virus reverse transcription–polymerase chain reaction (RT-PCR). Among 81 pregnancy losses for which placental and/or fetal tissues were submitted, 18 (22%) were positive by Zika virus RT-PCR. Zika virus RT-PCR was positive on placental tissues from 38/363 (10%) live births with maternal serologic evidence of recent unspecified flavivirus infection and from 9/86 (10%) with negative maternal Zika virus immunoglobulin M (IgM) where possible maternal exposure occurred >12 weeks before serum collection. These results demonstrate that Zika virus RT-PCR testing of tissue specimens can provide a confirmed diagnosis of recent maternal Zika virus infection.

Zika virus RT-PCR and, in selected cases, immunohistochemical (IHC) testing, were performed at CDC's Infectious Diseases Pathology Branch (IDPB) on FFPE tissue specimens submitted from completed pregnancies (i.e., live births and pregnancy losses of any gestational age) with possible maternal Zika virus exposure.* Completed pregnancies in this report include those with evidence of possible recent Zika virus infection (from maternal, fetal, or infant specimens) and those that ultimately demonstrated no laboratory evidence of possible Zika virus infection. To determine the added diagnostic value of Zika virus tissue RT-PCR testing, results from nontissue clinical samples (i.e., serum and/or urine) reported by the submitting health department or CDC's Arboviral Diseases Branch, were categorized by maternal test results (Table 1) (*5*) and infant test results.† Tissue RT-PCR results are also summarized by maternal symptom status and trimester of infection or possible exposure.§ A subset of pregnancies that were also reported to the U.S. Zika Pregnancy Registry (USZPR)¶ were systematically reviewed to determine the presence of possible Zika virus–associated birth defects. Thus, the analysis of tissue RT-PCR results by the presence of possible birth defects was limited to these pregnancies. Infants and pregnancy losses with possible Zika virus–associated birth defects included pregnancies completed by December 25, 2016 that were reported to the USZPR and met the CDC surveillance case definition

* Possible exposure to Zika virus includes: 1) travel to or residence in an area at risk for Zika virus transmission and with a CDC travel notice, or 2) condomless sexual exposure to a partner who traveled to or lived in an area with risk of Zika virus transmission and a CDC travel notice during pregnancy or the periconceptional period (https://www.cdc.gov/zika/geo/index.html).

† Infant laboratory evidence categories apply to results of testing on infant or fetal clinical specimens (e.g., serum, cord blood, urine, cerebrospinal fluid, amniotic fluid), however if infant PRNT titers were not available, maternal serum PRNT titers were used. Categories include the following: confirmed congenital Zika virus infection = positive by Zika virus RT-PCR, Zika virus IgM positive and Zika virus PRNT titer ≥10; probable congenital Zika virus infection = Zika virus IgM-positive, no PRNT titers reported, or Zika and dengue virus PRNT titers ≥10; negative infant Zika virus test results = neither Zika virus RT-PCR nor Zika virus IgM positive results; no infant specimen test results reported = testing could be not performed, not reported, or pending. Only includes results of Zika virus clinical laboratory testing conducted in the United States and U.S. territories (https://wwwn.cdc.gov/nndss/conditions/zika/case-definition/2016/06/).

§ Trimester of infection or possible exposure is based on symptom onset date for symptomatic pregnant women or trimester(s) of suspected vectorborne or sexual exposure for asymptomatic pregnant women. Periconceptional exposure only is defined as infection or possible exposure during the 8 weeks before conception (6 weeks before and 2 weeks after the first day of the last menstrual period).

¶ U.S. Zika Pregnancy Registry inclusion criteria = pregnant women with laboratory evidence of Zika virus infection (positive or equivocal test results, regardless of whether they have had symptoms) and periconceptionally, prenatally, or perinatally exposed infants born to these women, and infants with laboratory evidence of congenital Zika virus infection (positive or equivocal test results, regardless of whether they have symptoms) and their mothers (https://www.cdc.gov/zika/reporting/registry.html).

TABLE 1. Categories for laboratory evidence of maternal Zika virus infection from testing of nontissue clinical samples (e.g., serum, urine)

Category	Definition
Confirmed recent Zika virus infection	Positive Zika virus RT-PCR, or Zika or dengue virus IgM positive or equivocal* with Zika virus PRNT titer ≥10 and dengue virus PRNT titer <10
Recent unspecified flavivirus infection	Zika virus RT-PCR negative or not performed, with Zika or dengue virus IgM positive, or equivocal with Zika virus and dengue virus PRNT titers ≥10
Maternal samples negative by Zika virus IgM, all or part of possible exposure occurred >12 weeks before serum collection	Zika virus RT-PCR negative or not performed, with Zika virus IgM negative, where all or part of possible maternal exposure occurred >12 weeks before serum collection date
Pending/Unknown	Test results unknown or pending
No evidence of Zika virus infection	Zika or dengue IgM positive or equivocal with Zika virus PRNT titer <10 regardless of dengue PRNT titer, or Zika virus IgM negative where all possible exposure occurred within 2–12 weeks of serum collection date
No maternal clinical samples tested	No maternal serum, urine, or other clinical specimens tested

Abbreviations: IgM = immunoglobulin M; PRNT = plaque-reduction neutralization test; RT-PCR = reverse transcription–polymerase chain reaction.
* Serology terminology varies by assay and nonnegative results can include positive, equivocal, presumptive positive, or possible positive results.

for possible Zika virus–associated birth defects as of May 18, 2017.** Completed pregnancies were classified as "tissue Zika virus RT-PCR–positive" if at least one placental (e.g., placental disc, umbilical cord, or fetal membranes) specimen or fetal/infant tissue specimen was positive by conventional Zika virus RT-PCR and confirmed by sequencing of PCR products (*2*). A positive Zika virus RT-PCR test result on placental tissues is evidence of maternal Zika virus infection. This report includes cases reported previously (*2*,*6*–*8*).

During 2016, tissue specimens from 627 completed pregnancies with possible maternal Zika virus exposure from the 50 states and DC were submitted to CDC and were tested by Zika virus tissue RT-PCR. These specimens included placental tissues from 546 live births and placental and/or fetal tissues from 81 pregnancy losses; IHC testing for Zika virus was also performed on specimens from 91 live births and pregnancy losses (15%), criteria for which are specified below. Overall, 78/627 (12%) had one or more placental or fetal tissue specimen that was positive for Zika virus by RT-PCR. Among the 91 completed pregnancies with tissue specimens tested by IHC, seven (8%) demonstrated IHC evidence of Zika virus infection (six from first trimester pregnancy losses and one from a second trimester pregnancy loss). All seven IHC-positive pregnancy losses were also tissue RT-PCR–positive. Because none of the placental specimens tested by IHC from third trimester pregnancy losses (n = 4) or live births (n = 47) was IHC-positive, beginning in March 2016, IHC testing of these specimen types was no longer routinely performed.

Among 546 live births, placental tissues from 60 (11%) were RT-PCR positive for Zika virus, including 38/363 (10%) from pregnancies with recent unspecified maternal flavivirus infection and 9/86 (10%) with negative maternal Zika virus IgM, where possible maternal exposure occurred >12 weeks before serum collection (after which time maternal Zika virus IgM antibodies might have waned) (*5*) (Table 2). Zika virus RT-PCR was negative on placental tissues from 34/47 (72%) live births with confirmed recent maternal Zika virus infection, and from all three live births in which the infant had confirmed congenital Zika virus infection based on infant testing. Among live births with no evidence of maternal Zika virus infection (n = 14) or no maternal clinical specimens tested (n = 34), none was tissue RT-PCR–positive. Overall, Zika virus RT-PCR was positive on placental tissues from 47/482 (10%) live births without a confirmed diagnosis by Zika virus testing on maternal or infant clinical specimens, confirming a diagnosis of recent maternal Zika virus infection (Figure).

Placental or fetal tissues from 18 (22%) of the 81 pregnancy losses tested positive for Zika virus by RT-PCR, including 4/13 (31%) with recent unspecified maternal flavivirus infection, 2/18 (11%) with negative maternal Zika virus IgM, where possible maternal exposure occurred >12 weeks before serum collection, and 1/16 (6%) with no maternal clinical samples tested (Table 2). Among 14 pregnancy losses with no evidence of maternal Zika virus infection, no placental or fetal tissues tested RT-PCR–positive. Ten of 28 (36%) first trimester pregnancy losses and 5/17 (29%) third trimester pregnancy losses were tissue RT-PCR–positive, compared with only 3/35 (9%) second trimester losses (Table 2). However, 13/28 (46%) first trimester pregnancy losses had evidence of confirmed recent maternal Zika virus infection from clinical specimens, compared with 5/35 (14%) of second trimester and 1/17 (6%) third trimester pregnancy losses.

Among the 627 completed pregnancies included in this report, 449 (72%) were included in the USZPR (Table 2). Thirty live births were reported to have possible Zika virus–associated birth defects. Sixteen of these (53%) were

** Birth defects include those that met the USZPR surveillance case definition for birth defects potentially associated with Zika virus infection during pregnancy as of May 18, 2017. These birth defects include brain abnormalities and/or microcephaly; intracranial calcifications; ventriculomegaly; neural tube defects and other early brain malformations; eye abnormalities; or other consequences of central nervous system dysfunction including arthrogryposis (joint contractures), clubfoot, congenital hip dysplasia, and congenital deafness (https://www.cdc.gov/zika/geo/pregnancy-outcomes.html).

TABLE 2. Zika virus RT-PCR results from fixed placental and fetal tissue samples from completed pregnancies for which specimens* were submitted to CDC's Infectious Diseases Pathology Branch, by pregnancy outcome — 50 U.S. states and District of Columbia (n = 627), including 449 reported to the U.S. Zika Pregnancy Registry, January–December 2016

All completed pregnancies from which tissue specimens were submitted (n = 627)				
	Live births (n = 546)		Pregnancy losses (n = 81)	
Characteristic	Live births with tissue specimens tested, no.	Tissue RT-PCR positive,† no. (%)	Pregnancy losses with tissue specimens tested, no.	Tissue RT-PCR positive, no. (%)
Total	**546**	**60 (11)**	**81**	**18 (22)**
Maternal clinical Zika virus test results§				
Confirmed recent Zika virus infection	47	13 (28)	19	11 (58)
Recent unspecified flavivirus infection	363	38 (10)	13	4 (31)
Maternal samples negative by Zika virus IgM, all or part of possible exposure occurred >12 weeks before serum collected¶	86	9 (10)	18	2 (11)
No maternal clinical samples tested**	34	—	16	1 (6)
Pending/Unknown	2	—	1	—
No evidence of possible Zika virus infection	14	—	14	—
Infant clinical Zika virus test results††				
Confirmed congenital Zika virus infection	3	—	NA	NA
Probable congenital Zika virus infection	46	9 (20)	NA	NA
Negative Zika virus testing	358	39 (11)	NA	NA
No results reported	139	12 (9)	NA	NA
Trimester of infection or possible exposure§§				
First trimester only	90	9 (10)	41	12 (29)
Multiple trimesters, including first	291	32 (11)	24	4 (17)
Second and/or third trimester only	149	18 (12)	4	—
Periconceptional only	11	1 (9)	10	2 (20)
Unknown/Missing	5	—	2	—
Maternal symptom status				
Asymptomatic	366	37 (10)	56	7 (13)
Symptomatic	176	23 (13)	25	11 (44)
Unknown	4	—	—	—
Trimester of pregnancy loss				
Pregnancy loss, first trimester	NA	NA	28	10 (36)
Pregnancy loss, second trimester	NA	NA	35	3 (9)
Pregnancy loss, third trimester	NA	NA	17	5 (29)
Missing	NA	NA	1	—

Completed pregnancies reported to the U.S. Zika Pregnancy Registry¶¶ (n = 449)				
Characteristic	Live births (n = 414)		Pregnancy losses (n = 35)	
Total	**414**	**60 (14)**	**35**	**18 (51)**
Possible Zika virus–associated birth defects***				
Birth defects reported	30	16 (53)	4	2 (50)
No birth defects reported	384	44 (11)	31	16 (52)

Abbreviations: IgM = immunoglobulin M; NA = not applicable; PRNT = plaque-reduction neutralization test; RT-PCR = reverse transcription–polymerase chain reaction.

* Includes placental specimens (placenta, fetal membranes, or umbilical cord) for all 546 live births and infant autopsy specimens for six of nine neonatal deaths. For pregnancy losses (spontaneous abortions, terminations, and stillbirths), includes placental specimens (placenta, fetal membranes, or umbilical cord) for 62 and fetal specimens for 58 pregnancy losses; both fetal and placental tissues were submitted for 38 cases.

† Tissue RT-PCR positive = at least one placental or fetal tissue specimen was positive by Zika virus RT-PCR.

§ Confirmed recent Zika virus infection = positive Zika virus RT-PCR, or Zika or dengue virus IgM positive or equivocal with Zika virus plaque-reduction neutralization test (PRNT) titer ≥10 and dengue virus PRNT titer <10; Recent unspecified flavivirus infection = negative or no Zika virus RT-PCR performed, with Zika or dengue virus IgM positive, or equivocal with Zika virus and dengue virus PRNT titers ≥10; Maternal samples negative by Zika virus IgM, all or part of possible exposure occurred >12 weeks before serum collection date = negative or no Zika virus RT-PCR performed; Zika virus IgM negative with all or part of possible exposure occurring >12 weeks before serum collection date; Pending/Unknown = Test results unknown or pending; No evidence of Zika virus infection = Zika or dengue virus IgM positive or equivocal with Zika virus PRNT titer <10 regardless of dengue virus PRNT titer, or Zika IgM negative where all possible exposure occurred within 2–12 weeks of serum collection date. Applies to results of testing on maternal clinical specimens (e.g., serum, urine). Only includes results of Zika virus clinical laboratory testing conducted in the United States and U.S. territories.

¶ Includes nine live births with negative maternal Zika virus IgM and Zika and dengue virus PRNT titers ≥10.

** Includes two live births with negative maternal Zika virus RT-PCR on serum or urine where all or part of possible exposure occurred >12 weeks before specimen collection date and no Zika virus IgM testing was performed.

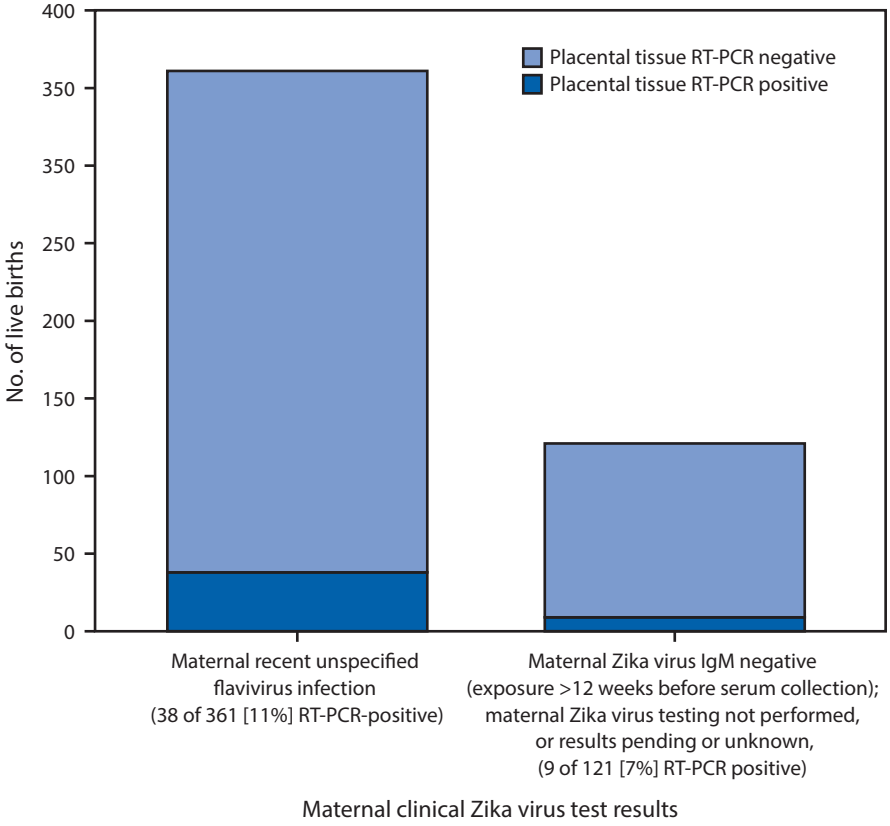
†† Confirmed congenital Zika virus infection = positive Zika virus RT-PCR, Zika virus IgM positive and Zika virus PRNT titer ≥10; Probable congenital Zika virus infection = Zika virus IgM-positive, no PRNT titers reported, or Zika and dengue virus PRNT titers ≥10; Negative infant Zika virus test results = neither Zika virus RT-PCR nor Zika virus IgM positive results; No infant specimen test results reported = testing could be not performed, not reported, or pending. Applies to results of testing on infant or fetal clinical specimens (e.g., serum, cord blood, urine, cerebrospinal fluid, amniotic fluid), however if infant PRNT titers not available, maternal serum PRNT titers were used. Only includes results of Zika virus clinical laboratory testing conducted in the United States and U.S. territories.

§§ Trimester of infection or possible exposure is based on symptom onset date for symptomatic pregnant women, and for asymptomatic women was based on trimester(s) of suspected vectorborne or sexual exposure. Periconceptional exposure only is defined as infection or possible exposure during the 8 weeks before conception (6 weeks before and 2 weeks after the first day of the last menstrual period).

¶¶ U.S. Zika Pregnancy Registry inclusion criteria = Pregnant women with laboratory evidence of Zika virus infection (positive or equivocal test results, regardless of whether they have had symptoms) and periconceptionally, prenatally, or perinatally exposed infants born to these women, and infants with laboratory evidence of congenital Zika virus infection (positive or equivocal test results, regardless of whether they had symptoms) and their mothers (https://www.cdc.gov/zika/reporting/registry.html).

*** Birth defects include those that met the U.S. Zika Pregnancy Registry surveillance case definition for birth defects potentially associated with Zika virus infection during pregnancy as of May 18, 2017. These birth defects include brain abnormalities and/or microcephaly, intracranial calcifications, ventriculomegaly, neural tube defects and other early brain malformations, eye abnormalities, or other consequences of central nervous system dysfunction including arthrogryposis (joint contractures), clubfoot, congenital hip dysplasia, and congenital deafness (https://www.cdc.gov/zika/geo/pregnancy-outcomes.html).

FIGURE. Zika virus placental tissue RT-PCR results, among live births with neither clinical laboratory evidence of confirmed recent Zika virus infection on maternal testing nor confirmed congenital Zika virus infection on infant testing (n = 482),*,†,§ by maternal clinical Zika virus test results categories¶, — 50 U.S. states and the District of Columbia, January–December, 2016**



Abbreviations: IgM = immunoglobulin M; PRNT= plaque-reduction neutralization test; RT-PCR = reverse transcription–polymerase chain reaction.

* Excludes live births with confirmed recent maternal Zika virus infection (positive Zika virus RT-PCR, or Zika or dengue virus IgM-positive or equivocal with Zika virus PRNT titer ≥10 and dengue virus PRNT titer <10) or no evidence of Zika virus infection (Zika or dengue virus IgM positive or equivocal with Zika virus PRNT titer <10 regardless of dengue PRNT titer, or Zika virus IgM negative where all possible exposure occurred within 2–12 weeks of serum collection date), or confirmed congenital Zika virus infection based on infant testing (positive Zika virus RT-PCR or Zika virus IgM positive and Zika virus PRNT titer ≥10 with dengue virus PRNT titer <10).

† Includes 41 live births where infants had laboratory evidence of probable congenital Zika virus infection; 9/41 (22%) with placental tissue RT-PCR positive; and 441 live births where infants had negative Zika virus testing or no Zika virus testing reported; 38/441 (9%) with placental tissue RT-PCR positive. Positive placental tissue RT-PCR results provide evidence of confirmed recent maternal Zika virus infection.

§ Placental tissue RT-PCR positive = at least one placental tissue specimen was positive by Zika virus RT-PCR.

¶ Recent unspecified flavivirus infection = negative or no Zika virus RT-PCR performed, with Zika or dengue virus IgM positive, or equivocal with Zika and dengue virus PRNT titers ≥10.

** Maternal samples negative by Zika virus IgM, all or part of possible exposure occurred >12 weeks before serum collection date with negative or no Zika virus RT-PCR performed, maternal Zika virus testing not performed, or results pending or unknown.

Zika virus RT-PCR–positive on placental tissues; however, a positive placental tissue RT-PCR cannot distinguish between maternal and congenital infection. Ten of these 16 had recent unspecified maternal flavivirus infection, and six had negative maternal Zika virus IgM, where possible maternal exposure occurred >12 weeks before serum collection. Among nine live births with negative maternal Zika IgM, where possible maternal exposure occurred >12 weeks before serum collection, and placental tissue RT-PCR was positive, six had possible Zika virus–associated birth defects.

Discussion

Among live births, placental tissue RT-PCR provided confirmation of recent maternal Zika virus infection for 47 (10%) women who otherwise did not have a definitive diagnosis. Given the complexity of Zika virus testing and interpretation, tissue specimen analysis provides another opportunity to confirm maternal Zika virus infection. A definitive maternal diagnosis of Zika virus infection provides valuable information to guide the evaluation and management of infants with possible congenital exposure.

Placental tissue RT-PCR testing was positive in a relatively low proportion of live births with recent unspecified maternal flavivirus infection (10%) or negative maternal Zika virus IgM on serum collected >12 weeks after possible exposure (10%). Placental testing might provide additional diagnostic information and can continue to be considered in these scenarios (https://www.cdc.gov/zika/pdfs/placental-testing-guidance.pdf), depending on the availability of public health resources. The yield of Zika virus testing of placental tissues should continue to be reassessed as additional data are collected.

Placental tissues have both maternal and fetal components, and Zika RT-PCR cannot discriminate between viral RNA from maternal and fetal areas (*9*). Although placental testing cannot confirm or exclude congenital Zika virus infection, infants might be more likely to receive appropriate clinical evaluation when a mother has confirmed recent Zika virus infection. Negative placental RT-PCR results do not rule out maternal or congenital Zika virus infection; evaluation of pregnant women and infants for Zika virus in accordance with CDC guidance is essential to direct appropriate infant clinical management and follow-up (*3*,*4*). Infant Zika virus testing and neuroimaging should not be delayed while results of placental testing are pending.

Among live births with possible Zika virus–associated birth defects reported to the USZPR and included in this analysis, 53% were Zika virus RT-PCR–positive on placental tissues. The implications of a positive placental Zika virus RT-PCR for infant clinical outcomes are currently unknown. However, further study could explore the relationship between the presence of Zika virus RNA in placental specimens, fetal infection, and development of possible Zika virus–associated birth defects.

In this report, Zika virus IHC was only positive on fetal and placental tissues from first and second trimester pregnancy losses. Zika virus IHC-positivity in brain tissues from infant deaths has been reported in other studies (*9*,*10*). Although all IHC-positive cases were also RT-PCR–positive, IHC can provide valuable insight into viral localization and pathogenesis in pregnancy losses and infant deaths.

The findings in this report are subject to at least five limitations. First, a negative Zika virus RT-PCR on placental tissues does not exclude maternal Zika virus infection. Factors that could lead to false-negative results include levels of viral RNA below the limit of assay detection, variability in tissue sampling, and degradation of viral RNA because of insufficient tissue fixation or prolonged formalin-fixation.†† Second, pregnancy outcomes in this analysis might not be representative of all pregnancies with possible Zika virus exposure, maternal Zika virus infection, or Zika virus–associated birth defects in the United States. Pregnancies ending in a loss or with fetuses or infants with birth defects might be more likely to have tissue specimens submitted, particularly among pregnancies with negative maternal Zika virus IgM >12 weeks after possible exposure. Third, possible testing bias limits the ability to compare placental test results by results of infant clinical laboratory testing, because infants with possible Zika virus–associated birth defects might be more likely to have Zika virus testing performed. Fourth, the approach to testing of placental and fetal tissues changed over time, which might have resulted in variability in testing bias over the reporting period. Changes included routinely testing tissue specimens for completed pregnancies where maternal Zika virus IgM was negative >12 weeks after possible exposure (beginning in August 2016) (*3*,*4*), and focusing testing of placental specimens from live births on those without a confirmed recent maternal Zika virus infection diagnosis (https://www.cdc.gov/zika/pdfs/placental-testing-guidance.pdf). Finally, clinical, epidemiologic, and laboratory information reflects data reported to USZPR and CDC's IDPB as of the date of this report, and might be incomplete.

†† Recommendations for specimen collection and submission are available at https://www.cdc.gov/zika/laboratories/test-specimens-tissues.html.

Summary

What is already known about this topic?

Zika virus infection during pregnancy can cause microcephaly and other brain abnormalities. Diagnosis of Zika virus infection is challenging because of serologic cross-reactivity with other related flaviviruses and limited duration of viremia. Zika virus RNA can be detected in placental and fetal tissues, which can provide an opportunity to diagnose maternal Zika virus infection and can be considered when maternal serologic testing is not definitive or is negative outside the optimal testing window.

What is added by this report?

In the 50 U.S. states and District of Columbia, placental testing provided a confirmed diagnosis of recent maternal Zika virus infection for 10% of live births with possible maternal exposure to Zika virus that lacked definitive evidence of a maternal or congenital Zika virus infection. This included pregnancies with clinical laboratory evidence of recent unspecified maternal flavivirus infection, and those with negative maternal Zika virus IgM, where possible maternal exposure occurred >12 weeks before serum collection.

What are the implications for public health practice?

Testing of placental tissues from live births provided definitive evidence of maternal Zika virus infection. Although the proportion of live births for which placental tissue was RT-PCR–positive for Zika virus was relatively low, testing of placental tissues from live births can continue to be considered when results of maternal Zika virus testing are not definitive or testing is not performed within the optimal time. Ensuring appropriate Zika virus testing and clinical follow-up of infants, according to published CDC guidance is critical in order to identify congenital Zika virus infection.

These findings describe the contributions of testing placental and fetal tissue specimens for Zika virus infection to the diagnosis of maternal infection. Although the proportion of live births with placental tissues positive for Zika virus by RT-PCR was low, tissue analysis can be valuable when maternal serologic testing either cannot differentiate between Zika virus and other related flaviviruses, or has been conducted >12 weeks after possible maternal exposure, and infant Zika virus testing is not definitive, negative, or not performed. Tissue analysis provides another opportunity to confirm maternal Zika virus infection, which can be important to both families and health care providers. However, because a positive Zika virus RT-PCR on placental tissues cannot distinguish between maternal and congenital infection, following current CDC guidance for clinical diagnostic testing and management of pregnant women with possible Zika virus exposure and infants with possible congenital Zika virus infection continues to be important (*3*,*4*).

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Conflict of Interest

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References

1. Rasmussen SA, Jamieson DJ, Honein MA, Petersen LR. Zika virus and birth defects—reviewing the evidence for causality. N Engl J Med 2016;374:1981–7. https://doi.org/10.1056/NEJMsr1604338
2. Bhatnagar J, Rabeneck DB, Martines RB, et al. Zika virus RNA replication and persistence in brain and placental tissue. Emerg Infect Dis 2017;23:405–14. https://doi.org/10.3201/eid2303.161499

3. Russell K, Oliver SE, Lewis L, et al. Update: interim guidance for the evaluation and management of infants with possible congenital Zika virus infection—United States, August 2016. MMWR Morb Mortal Wkly Rep 2016;65:870–8. https://doi.org/10.15585/mmwr.mm6533e2
4. Oduyebo T, Igbinosa I, Petersen EE, et al. Update: interim guidance for health care providers caring for pregnant women with possible Zika virus exposure—United States, July 2016. MMWR Morb Mortal Wkly Rep 2016;65:739–44. https://doi.org/10.15585/mmwr.mm6529e1
5. Rabe IB, Staples JE, Villanueva J, et al.; MTS. Interim guidance for interpretation of Zika virus antibody test results. MMWR Morb Mortal Wkly Rep 2016;65:543–6. https://doi.org/10.15585/mmwr.mm6521e1
6. Honein MA, Dawson AL, Petersen EE, et al.; US Zika Pregnancy Registry Collaboration. Birth defects among fetuses and infants of US women with evidence of possible Zika virus infection during pregnancy. JAMA 2017;317:59–68. https://doi.org/10.1001/jama.2016.19006
7. Meaney-Delman D, Hills SL, Williams C, et al. Zika virus infection among U.S. pregnant travelers—August 2015–February 2016. MMWR Morb Mortal Wkly Rep 2016;65:211–4. https://doi.org/10.15585/mmwr.mm6508e1
8. Reynolds MR, Jones AM, Petersen EE, et al.; US Zika Pregnancy Registry Collaboration. Vital signs: update on Zika virus–associated birth defects and evaluation of all U.S. infants with congenital Zika virus exposure—U.S. Zika Pregnancy Registry, 2016. MMWR Morb Mortal Wkly Rep 2017;66:366–73. https://doi.org/10.15585/mmwr.mm6613e1
9. Ritter JM, Martines RB, Zaki SR. Zika virus: pathology from the pandemic. Arch Pathol Lab Med 2017;141:49–59. https://doi.org/10.5858/arpa.2016-0397-SA
10. Martines RB, Bhatnagar J, de Oliveira Ramos AM, et al. Pathology of congenital Zika syndrome in Brazil: a case series. Lancet 2016;388:898–904. https://doi.org/10.1016/S0140-6736(16)30883-2

Screening for Syphilis and Other Sexually Transmitted Infections in Pregnant Women — Guam, 2014

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Prenatal screening and treatment for sexually transmitted infections (STIs) can prevent adverse perinatal outcomes. In Guam, the largest of the three U.S. territories in the Pacific, primary and secondary syphilis rates among women increased 473%, from 1.1 to 6.3 per 100,000 during 2009–2013 (*1*). In 2013, the first congenital syphilis case after no cases since 2008 was reported (*1*,*2*). Little is known about STI screening coverage and factors associated with inadequate screening among pregnant women in Guam. This study evaluated the prevalence of screening for syphilis, human immunodeficiency virus (HIV), chlamydia, and gonorrhea, and examined correlates of inadequate screening among pregnant women in Guam. Data came from the medical records of a randomly selected sample of mothers with live births in 2014 at a large public hospital. Bivariate analyses and multivariable models using Poisson regression were conducted to determine factors associated with inadequate screening for syphilis and other STIs. Although most (93.5%) women received syphilis screening during pregnancy, 26.8% were not screened sufficiently early to prevent adverse pregnancy outcomes. Many women were not screened for HIV infection (31.1%), chlamydia (25.3%), or gonorrhea (25.7%). Prenatal care and insurance were important factors affecting STI screening during pregnancy. Prenatal care providers play an important role in preventing congenital infections. Policies and programs increasing STI and HIV services for pregnant women and improved access to and use of prenatal care are essential for promoting healthy mothers and infants.

Syphilis, chlamydia, gonorrhea, and HIV infection in pregnant women can lead to mortality or severe morbidity in infants (*3*,*4*). Among pregnant women with untreated syphilis, an estimated 26% of pregnancies result in stillbirth and fetal loss, and another 12% in early neonatal death (*5*). Early prenatal screening and treatment is highly effective in reducing STI-related perinatal morbidity and mortality (*3*,*6*). The U.S. Preventive Services Task Force and CDC recommend screening all pregnant women for syphilis and HIV infection (*4*). Women should be screened for syphilis and HIV infection early in pregnancy at the first prenatal care visit to detect infections and initiate treatment before adverse outcomes occur (*3*). For syphilis, treatment in the first trimester and during the early second trimester can avert a majority of poor pregnancy outcomes caused by in utero infection (*6*). Women at increased risk for syphilis should be screened again at 28–32 weeks' gestation and at delivery to detect new infections (*3*). Guamanian laws require health care providers to screen women for syphilis during pregnancy (10 GCA § 3323). Current U.S. recommendations also include screening for chlamydia and gonorrhea among pregnant women aged ≤24 years and older women at increased risk (*4*).

In 2014, approximately 73% of all births in Guam occurred at Guam Memorial Hospital. Among 2,478 live births at Guam Memorial Hospital during 2014, records of a random sample of 971 (39.2%) were reviewed to ascertain whether and when mothers were screened for STIs during pregnancy. One infant from each of five twin pairs was excluded, resulting in a total sample of 966 live births. Records with unknown conception date (23 records), test date (45), or those that were unclear about whether a syphilis test was done (33) were excluded. Thus, only records with information on the primary outcome of interest, gestational age at the time of syphilis screening, were included for analysis (865). Records with no missing information for HIV screening (842), chlamydia screening (870), or gonorrhea screening (873) were assessed in secondary analyses. It was assumed that all pregnant women should be screened for chlamydia because the prevalence is high in Guam (*1*). Because chlamydia and gonorrhea are usually tested together using a combination test, it was expected that most pregnant women would also be screened for gonorrhea. Thus, analyses for chlamydia or gonorrhea screening were not restricted to younger women. Standardized chart abstractions were performed at the hospital to obtain sociodemographic, clinical, and laboratory data. Medical records included information on prenatal care, STI screening during pregnancy, and pregnancy history. All data were deidentified for analyses. The study was exempt from review by the University of Guam Institutional Review Board.

The primary outcome, gestational age at the time of syphilis screening, was categorized as early screening through the early second trimester (up to 24 weeks' gestation), late screening (after 24 weeks' gestation), very late screening (after 32 weeks' gestation), or no screening. Late screening after 24 weeks' gestation includes very late screening. Screening for HIV, chlamydia, and gonorrhea were each categorized as "yes" or "no." Potential correlates of STI screening included maternal age at delivery, race/ethnicity, education, employment status,

insurance, gravidity, source of prenatal care, trimester of first prenatal care visit, and number of prenatal care visits.

Descriptive statistics were generated to assess the prevalence of inadequate syphilis screening by maternal characteristics. Separate Poisson regression models provided unadjusted and adjusted prevalence ratios (APR) and 95% confidence intervals (CIs) to determine factors associated with screening for syphilis, HIV, chlamydia, and gonorrhea during pregnancy. All nine potential correlates of screening were included in the multivariable Poisson regression models for fully adjusted estimates. All analyses were conducted using statistical software.

The majority (84%) of women in the sample population were aged 18–34 years, Chamorro (46%) or Chuukese (26%) ethnicity, unemployed (69%), uninsured or recipients of government-assisted health programs (i.e., Medicaid, Medically Indigent Program [MIP]) (70%), and multigravidas (70%) (Table 1). Approximately 90% of women had some source of prenatal care; 72.4% of women initiated prenatal care by the second trimester, and 73.3% had four or more prenatal care visits. However, 14.8% of women who initiated care in the first trimester and 10.7% who initiated care in the second trimester were initially screened for syphilis in subsequent trimesters or not at all. Overall, 577 (66.7%) women were first screened for syphilis early in pregnancy (up to 24 weeks' gestation), 232 (26.8%) were screened late (after 24 weeks' gestation), 110 (12.7%) were first screened very late in pregnancy (after 32 weeks' gestation), and 56 (6.5%) had no screening (Table 1). Thus, approximately 33.3% did not have screening by 24 weeks' gestation, and 19.2% had very late or no screening.

In bivariate analyses, inadequate syphilis screening was associated with race/ethnicity, education, employment, insurance, gravidity, and prenatal care initiation and number of prenatal care visits (Table 1). After adjusting for all nine screening correlates, late prenatal care and low number of prenatal care visits were significantly associated with late or no syphilis screening (Table 1). Women who began prenatal care in their third trimester had 5.6 times the prevalence of late or no syphilis screening compared with women who received care in their first trimester. Women with fewer prenatal care visits or no prenatal care had a four- to fivefold increase in prevalence of late or no syphilis screening compared with women with 11 or more prenatal care visits (Table 1). Similar results were observed when assessing correlates of very late or no syphilis screening.

Approximately 31.1% of women were not screened for HIV, 25.3% were not screened for chlamydia, and 25.7% were not screened for gonorrhea during pregnancy. In the multivariable regression model, insurance type, source of prenatal care, and fewer visits were significantly associated with lack of HIV screening (Table 2). Women with no insurance and those enrolled in Medicaid or MIP had twice the prevalence of not receiving HIV screening compared with privately insured women. Women with fewer than four prenatal care visits had 3.8 times the prevalence of no HIV screening compared with women with the currently recommended 11 or more prenatal care visits. Women who received prenatal care from a public clinic had a lower prevalence of no HIV screening than did those receiving care from private clinics (APR = 0.5, 95% CI = 0.3–0.7). Moreover, lack of screening for chlamydia or gonorrhea was associated with race/ethnicity, employment, insurance, source of prenatal care, prenatal care initiation, and number of prenatal care visits; however, differences were not statistically significant in fully adjusted models. Screening for chlamydia or gonorrhea did not differ across age groups.

Discussion

During a time of substantial increases in syphilis infection among women in Guam (*1*), one in three pregnant women in Guam were not screened for syphilis sufficiently early to prevent adverse pregnancy outcomes. Although no congenital syphilis was reported for Guam in 2014, another case occurred in 2015 for a rate of 30.4 per 100,000 live births (*1*). Risk factors for inadequate syphilis screening included delayed initiation of first prenatal visit and low frequency of prenatal visits; however, even women with multiple prenatal care visits did not always have adequate syphilis screening. Many women were also not screened for HIV infection, chlamydia, and gonorrhea during pregnancy, including those with multiple prenatal care visits. Those with government-assisted health care or no insurance and low number of prenatal care visits had a high prevalence of no HIV screening.

Because national data are not collected, relatively few studies have assessed prenatal STI screening in the United States, and available studies have had varying results. One study assessing a stratified random sample of birth records in eight U.S. states during 1998–1999 found that few women (1.7%) had no documented prenatal care, and there was a high rate of prenatal screening for syphilis (98.2%) but low screening for HIV infection (57.2%) (*7*). HIV screening was more common among women with Medicaid payment, blacks, and women aged <20 years. Another study, using 2009–2010 administrative claims data for women who received prenatal care in multiple U.S. states, reported high prenatal screening for syphilis (96.3%–97.8%) and lower screening for HIV infection (82.4%–85.4%), chlamydia (70.3%–83.1%), and gonorrhea (68.6%–74.8%); however, prenatal screening for specific STIs was similar among Medicaid and commercially insured women (*8*). This finding was in contrast to the data from Guam which indicated that more women covered by Medicaid or MIP had

TABLE 1. Percentage and prevalence ratios of late or no syphilis screening among women who delivered at Guam Memorial Hospital, by maternal characteristics — Guam, 2014

Maternal characteristic (no. with available information)	Total no. (%) (N = 865)	% Late/No screening* (n = 288)	Unadjusted PR (95% CI)†	Adjusted PR (95% CI)†,§
Age at delivery, yrs (865)				
15–17	23 (2.7)	39.1	1.4 (0.7–3.0)	1.1 (0.5–2.5)
18–24	320 (37.0)	34.7	1.3 (0.8–1.9)	1.0 (0.6–1.8)
25–34	410 (47.4)	33.4	1.2 (0.8–1.8)	1.1 (0.7–1.8)
35–45	112 (12.9)	27.7	1.0	1.0
Race/Ethnicity (862)				
Chamorro	395 (45.8)	27.1	1.0	1.0
Chuukese	224 (26.0)	55.8	2.1 (1.6–2.7)†	0.9 (0.6–1.4)
Native Hawaiian and Other Pacific Islander¶	68 (7.9)	44.1	1.6 (1.1–2.4)†	0.8 (0.5–1.4)
Filipino	123 (14.3)	9.8	0.4 (0.2–0.7)†	0.5 (0.3–1.1)
Others	52 (6.0)	25.0	0.9 (0.4–1.6)	0.9 (0.4–1.8)
Education (828)				
<High school diploma	178 (21.5)	50.0	2.8 (1.9–4.1)†	1.1 (0.7–1.7)
High school diploma	452 (54.6)	34.3	1.9 (1.3–2.7)†	1.0 (0.7–1.6)
>High school diploma	198 (23.9)	18.2	1.0	1.0
Employed (849)				
Yes	265 (31.2)	15.5	1.0	1.0
No	584 (68.8)	41.4	2.7 (1.9–3.7)†	1.2 (0.8–1.8)
Insurance (852)				
None	135 (15.8)	57.8	4.4 (2.9–6.6)†	1.3 (0.7–2.2)
Medicaid	275 (32.2)	28.7	2.2 (1.5–3.3)†	0.8 (0.5–1.4)
MIP**	188 (22.1)	48.4	3.7 (2.5–5.5)†	1.1 (0.6–1.9)
Private	252 (29.6)	13.1	1.0	1.0
Other	2 (0.2)	100.0	7.6 (1.8–31.8)†	3.3 (0.7–14.7)
Gravidity (576)				
1	171 (29.7)	25.7	1.0	1.0
2	133 (23.1)	31.1	1.2 (0.9–1.7)	1.1 (0.7–1.6)
3	112 (19.4)	32.9	1.3 (0.9–1.9)	1.0 (0.6–1.6)
≥4	160 (27.8)	41.4	1.6 (1.2–2.2)†	1.2 (0.8–1.9)
Source of PNC (849)				
Public	361 (42.6)	36.3	2.1 (1.6–2.9)†	1.0 (0.7–1.5)
Private	383 (45.1)	17.0	1.0	1.0
Other	19 (2.2)	10.5	0.6 (0.2–2.5)	0.7 (0.1–5.1)
None	86 (10.1)	96.5	5.7 (4.1–7.9)	1.5 (0.2–11.2)
Trimester of first PNC visit (823)				
1st	278 (33.8)	5.0	1.0	1.0
2nd	318 (38.6)	19.8	3.9 (2.2–7.0)†	2.0 (1.0–3.7)
3rd	138 (16.8)	73.2	14.5 (8.3–25.4)†	5.6 (2.9–10.6)†
No PNC	89 (10.8)	95.5	19.0 (10.8–33.4)†	4.0 (0.5–31.9)
No. of PNC visits (834)				
0–3	223 (26.7)	73.1	21.8 (9.7–49.3)†	4.6 (1.7–12.9)†
4–6	197 (23.6)	34.0	10.2 (4.4–23.4)†	4.0 (1.5–11.0)†
7–10	235 (28.2)	14.0	4.2 (1.8–10.0)†	2.4 (0.9–6.5)
≥11	179 (21.5)	3.4	1.0	1.0

Abbreviations: CI = confidence interval; MIP = medically indigent program; PNC = prenatal care; PR = prevalence ratio.
* Late screening after 24 weeks' gestation includes very late screening.
† Statistically significant.
§ Estimates adjusted for maternal age, race/ethnicity, education, employment, insurance, gravidity, source of prenatal care, prenatal care initiation, and number of visits.
¶ Other Pacific Islander groups include Kosraean, Marshallese, Palauan, Pohnpeian, and Yapese.
** MIP provides financial assistance for health care services to Guam residents not eligible for Medicaid or Medicare.

late or no syphilis screening (28.7%–48.4%) compared with privately insured women (13.1%).

Access to and use of quality prenatal care are essential for healthy pregnancies. A recent World Health Organization study estimated that 80% of adverse pregnancy outcomes caused by syphilis in 2012 occurred in women who received prenatal care. However, many did not receive recommended early screening and treatment, suggesting that multiple perinatal deaths and complications could have been prevented with appropriate adherence to recommendations (*9*). In the current study, 72.4% of women had initiated prenatal care by their second trimester, but overall, 26.8% had delayed syphilis screening and 6.5% had no screening. Approximately 10% of women lacked prenatal care, a higher percentage than

TABLE 2. Prevalence ratios for lack of screening for HIV, chlamydia, or gonorrhea during pregnancy among women who delivered at Guam Memorial Hospital, by maternal characteristics — Guam, 2014

Maternal characteristic	HIV*,†		Chlamydia*,§		Gonorrhea*,¶	
	Unadjusted PR (95% CI)	Adjusted PR (95% CI)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age at delivery (yrs)						
15–17	1.2 (0.5–2.8)	0.9 (0.3–2.2)	0.7 (0.2–1.9)	0.6 (0.2–2.0)	0.7 (0.2–1.9)	0.6 (0.2–1.9)
18–24	1.2 (0.8–1.7)	0.9 (0.5–1.5)	0.9 (0.6–1.4)	0.9 (0.5–1.6)	0.9 (0.6–1.4)	0.9 (0.5–1.7)
25–34	1.1 (0.7–1.5)	0.9 (0.6–1.4)	0.9 (0.6–1.3)	0.9 (0.6–1.5)	0.9 (0.6–1.3)	0.9 (0.6–1.5)
35–45	1.0	1.0	1.0	1.0	1.0	1.0
Race/Ethnicity						
Chamorro	1.0	1.0	1.0	1.0	1.0	1.0
Chuukese	1.2 (0.9–1.6)	0.8 (0.5–1.2)	1.9 (1.4–2.6)*	0.8 (0.5–1.4)	1.9 (1.4–2.5)*	0.8 (0.5–1.4)
Native Hawaiian and Other Pacific Islander**	0.9 (0.6–1.5)	0.7 (0.3–1.3)	1.1 (0.6–1.9)	0.8 (0.4–1.6)	1.1 (0.6–1.9)	0.8 (0.4–1.6)
Filipino	0.5 (0.3–0.8)*	0.8 (0.4–1.5)	0.8 (0.5–1.4)	1.0 (0.6–1.8)	0.9 (0.5–1.4)	1.0 (0.6–1.8)
Others	0.8 (0.5–1.4)	0.8 (0.4–1.8)	1.8 (1.1–3.0)*	1.2 (0.6–2.4)	1.9 (1.2–3.1)*	1.1 (0.5–2.3)
Education						
<High school diploma	2.6 (1.7–4.0)*	1.2 (0.7–2.1)	1.4 (1.0–2.1)	0.8 (0.5–1.3)	1.4 (0.9–2.0)	0.7 (0.4–1.2)
High school diploma	2.1 (1.4–3.1)*	1.2 (0.8–2.0)	1.1 (0.8–1.5)	0.7 (0.4–1.0)	1.0 (0.7–1.5)	0.6 (0.4–1.0)
>High school diploma	1.0	1.0	1.0	1.0	1.0	1.0
Employed						
Yes	1.0	1.0	1.0	1.0	1.0	1.0
No	1.8 (1.4–2.5)*	0.9 (0.6–1.4)	1.6 (1.1–2.2)*	1.0 (0.6–1.6)	1.6 (1.1–2.2)*	1.0 (0.6–1.6)
Insurance						
None	3.2 (2.1–4.9)*	2.3 (1.2–4.2)*	3.3(2.3–4.8)*	1.4 (0.7–2.7)	3.3 (2.2–4.8)*	1.4 (0.7–2.6)
Medicaid	2.8 (1.9–4.1)*	2.1 (1.3–3.6)*	1.1 (0.7–1.7)	0.8 (0.4–1.5)	1.1 (0.7–1.7)	0.8 (0.4–1.5)
MIP††	2.5 (1.7–3.9)*	2.4 (1.2–4.4)*	1.6 (1.0–2.4)	1.0 (0.5–2.1)	1.5 (1.0–2.3)	1.0 (0.5–2.0)
Private	1.0	1.0	1.0	1.0	1.0	1.0
Other	7.4 (1.8–30.6)*	10.1(2.1–5.4)*	0.0	0.0	0.0	0.0
Gravidity						
1	1.0	1.0	1.0	1.0	1.0	1.0
2	1.3 (0.9–1.8)	1.0 (0.7–1.6)	1.1 (0.8–1.6)	0.8 (0.5–1.3)	1.0 (0.7–1.5)	0.8 (0.5–1.3)
3	1.4 (0.9–2.0)	1.1 (0.7–1.8)	1.1 (0.8–1.8)	0.8 (0.5–1.4)	1.1 (0.8–1.7)	0.8 (0.5–1.4)
≥4	1.4 (1.0–2.0)	0.9 (0.6–1.5)	1.2 (0.8–1.7)	0.8 (0.5–1.3)	1.0 (0.7–1.5)	0.8 (0.4–1.3)
Source of PNC						
Public	0.9 (0.6–1.2)	0.5 (0.3–0.7)*	0.9 (0.6–1.3)	0.8 (0.5–1.4)	0.9 (0.6–1.3)	0.8 (0.5–1.4)
Private	1.0	1.0	1.0	1.0	1.0	1.0
Other	1.0 (0.4–2.6)	1.1 (0.4 –3.7)	0.3 (0.0–2.3)	0.6 (0.1–4.1)	0.3 (0.0–2.2)	0.6 (0.1–4.3)
None	4.2 (3.1–5.6)*	0.7 (0.2–3.2)	6.4 (4.6–8.9)*	1.2 (0.2–9.6)	6.2 (4.5–8.5)*	1.4(0.2–10.6)
Trimester of first PNC visit						
1st	1.0	1.0	1.0	1.0	1.0	1.0
2nd	1.6 (1.0–2.4)	1.0 (0.6–1.5)	1.1 (0.7–1.7)	1.1 (0.6–2.1)	1.1 (0.7–1.8)	1.1 (0.6–2.1)
3rd	2.2 (1.4– 3.4)*	1.0 (0.5–1.7)	1.7 (1.0–2.8)	1.4 (0.7–2.9)	2.0 (1.2–3.3)*	1.6 (0.8 –3.3)
No PNC	7.2(4.9–10.5)*	2.2 (0.5–9.6)	8.9(6.0–13.4)*	5.5 (0–44.0)	9.2 (6.2–13.9)*	5.6(0.7–44.6)
No. of PNC visits						
0–3	6.6(4.0–10.9)*	3.8 (1.8–7.9)*	4.1(2.7–6.4)*	1.5 (0.6–3.4)	4.4 (2.8–6.8)*	1.5(0.6– 3.4)
4–6	2.9 (1.7–5.0)*	3.1 (1.6–5.9)*	1.1 (0.6 –1.8)	1.2 (0.6–2.5)	1.2 (0.7–2.1)	1.3 (0.6–2.8)
7–10	1.4 (0.8–2.5)	1.4 (0.7–2.7)	0.8 (0.4–1.4)	0.8 (0.4–1.6)	0.8 (0.4–1.5)	0.8 (0.4–1.7)
≥11	1.0	1.0	1.0	1.0	1.0	1.0

Abbreviations: CI = confidence interval; HIV = human immunodeficiency virus; MIP = medically indigent program; PNC = prenatal care; PR = prevalence ratio.
* Statistically significant.
† Restricted to records with no missing information on HIV screening (n = 842).
§ Restricted to records with no missing information on chlamydia screening (n = 870).
¶ Restricted to records with no missing information on gonorrhea screening (n = 873).
** Other Pacific Islander groups include Kosraean, Marshallese, Palauan, Pohnpeian, and Yapese.
†† MIP provides financial assistance for health care services to Guam residents not eligible for Medicaid or Medicare.

women in the U.S. states (*10*). However, these results indicate substantial missed opportunities for screening because 15% of women who initiated care in their first trimester and 11% in their second trimester were first screened for syphilis in subsequent trimesters or not at all.

The findings in this report are subject to at least five limitations. First findings from Guam might not be generalizable to other U.S. territories or Pacific Island nations or to the 50 U.S. states. Nonetheless, the current study addresses an important issue in a population that has been largely underrepresented in

Summary

What is already known about this topic?

Current screening guidelines recommend early prenatal screening for syphilis and other sexually transmitted infections (STIs), because untreated infections can lead to adverse perinatal outcomes. In areas with increasing and high STI-related morbidity like Guam, prenatal screening coverage for STIs, and correlates of inadequate screening are not well understood.

What is added by this report?

Although the majority of pregnant women received prenatal care in Guam, nearly one third were not screened for syphilis and HIV infection, and one quarter were not screened for chlamydia and gonorrhea, as recommended. Few or no prenatal care visits, lack of insurance, and public insurance were associated with inadequate STI screening during pregnancy.

What are the implications for public health practice?

Prenatal care providers play an important role in perinatal STI prevention through early and routine screening for infections and providing appropriate treatment and follow up care. Policies and programs that increase STI and HIV services among pregnant women and improve access to and use of early prenatal care are essential for promoting healthy mothers and infants.

extant literature. Second, live births from other facilities were not included, but Guam Memorial Hospital delivers most births in Guam. Third, some medical records had limited information on prenatal STI screening; however, multiple data sources were used to ensure completeness of data (e.g., laboratory reports, prenatal care records, labor and delivery charts). Fourth, because of the small sample size, gestational age at the time of syphilis screening could not be assessed in multiple categories (e.g., trimester of screening). Finally, because relatively few studies have evaluated STI screening among women, determining which variables are confounders or intermediates that would explain attenuated differences in fully adjusted models was difficult.

Many women were screened late or not at all for syphilis and other STIs during pregnancy. The U.S. rate of reported congenital syphilis has been increasing in tandem with increases in primary and secondary syphilis rates among women (*1*). This finding underscores the urgent need to screen all pregnant women and strengthen programs that provide STI, HIV, and perinatal services, particularly in areas like Guam, where resources are limited. Prenatal care providers and other health care workers play an important role in preventing congenital infections through routine early screening, treatment, and follow-up care. Further exploring strategies that improve prenatal screening practices in the health care system (e.g., provider education, standing orders, and opt-out testing) is essential for addressing challenges with screening adherence, even in areas with mandated screening laws. Policies and programs that support and improve use of quality prenatal care with early STI screening, particularly among women with limited resources or access to care, are essential for promoting healthy mothers and infants.

Conflict of Interest

No conflicts of interest were reported.

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References

1. CDC. Sexually transmitted disease surveillance 2015. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/std/stats15/std-surveillance-2015-print.pdf
2. CDC. Sexually transmitted disease surveillance 2010. Atlanta, GA: US Department of Health and Human Services, CDC; 2011. https://www.cdc.gov/std/stats10/surv2010.pdf
3. Workowski KA, Bolan GA. Sexually transmitted diseases treatment guidelines, 2015. MMWR Recomm Rep 2015;64(No. RR-3).
4. Lee KC, Ngo-Metzger Q, Wolff T, Chowdhury J, LeFevre ML, Meyers DS. Sexually transmitted infections: recommendations from the U.S. Preventive Services Task Force. Am Fam Physician 2016;94:907–15.
5. Gomez GB, Kamb ML, Newman LM, Mark J, Broutet N, Hawkes SJ. Untreated maternal syphilis and adverse outcomes of pregnancy: a systematic review and meta-analysis. Bull World Health Organ 2013;91:217–26. https://doi.org/10.2471/BLT.12.107623
6. Qin J, Yang T, Xiao S, Tan H, Feng T, Fu H. Reported estimates of adverse pregnancy outcomes among women with and without syphilis: a systematic review and meta-analysis. PLoS One 2014;9:e102203. https://doi.org/10.1371/journal.pone.0102203
7. Schrag SJ, Arnold KE, Mohle-Boetani JC, et al. Prenatal screening for infectious diseases and opportunities for prevention. Obstet Gynecol 2003;102:753–60.
8. Ross CE, Tao G, Patton M, Hoover KW. Screening for human immunodeficiency virus and other sexually transmitted diseases among U.S. women with prenatal care. Obstet Gynecol 2015;125:1211–6. https://doi.org/10.1097/AOG.0000000000000756
9. Wijesooriya NS, Rochat RW, Kamb ML, et al. Global burden of maternal and congenital syphilis in 2008 and 2012: a health systems modelling study. Lancet Glob Health 2016;4:e525–33. https://doi.org/10.1016/S2214-109X(16)30135-8
10. Ayoola AB, Nettleman MD, Stommel M, Canady RB. Time of pregnancy recognition and prenatal care use: a population-based study in the United States. Birth 2010;37:37–43. https://doi.org/10.1111/j.1523-536X.2009.00376.x

Progress Toward Containment of Poliovirus Type 2 — Worldwide, 2017

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The Global Polio Eradication Initiative (GPEI) continues to make progress toward the eradication target. Only one of the three serotypes, wild poliovirus (WPV) type 1 (WPV1), is still circulating, and the numbers of cases and countries with endemic transmission are at record lows. With the certification of wild poliovirus type 2 (WPV2) eradication in 2015 and the global replacement of trivalent oral poliovirus vaccine (tOPV) containing Sabin poliovirus types 1, 2, and 3 with bivalent OPV containing only Sabin poliovirus types 1 and 3 during April–May 2016, poliovirus type 2 (PV2) is now an eradicated pathogen. However, in eight countries (Cameroon, Chad, Democratic Republic of Congo, Mozambique, Niger, Nigeria, Pakistan, and Syria), monovalent type 2 OPV (mOPV2) was authorized for large-scale outbreak control after tOPV withdrawal (*1*). Poliovirus containment, an evolving area of work that affects every country, aims to ensure that all PV2 specimens are safely contained to minimize the risk for reintroducing the virus into communities. This report summarizes the current status of poliovirus containment and progress since the last report (*2*), and outlines remaining challenges. Within 30 countries, 86 facilities have been designated by the relevant national authorities (usually the Ministry of Health) to become poliovirus-essential facilities for the continued storage or handling of PV2 materials; each country is responsible for ensuring that these facilities meet all biorisk management requirements.

The Polio Eradication and Endgame Strategic Plan 2013–2018 (Endgame Plan) (*3*) of GPEI addresses four objectives: 1) poliovirus detection and interruption; 2) immunization systems strengthening and OPV withdrawal; 3) containment and certification; and 4) transition planning (previously referred to as legacy planning). Under objective 2, the Endgame Plan outlines the readiness criteria and the trigger point for initiating the phased withdrawal of vaccine viruses, starting with Sabin poliovirus type 2. The certification of eradication of WPV2 in 2015 activated the implementation of the containment work.

Indigenous WPV2 was last detected in 1999; it was certified as eradicated in September 2015 by the Global Commission for the Certification of the Eradication of Poliomyelitis (GCC). WPV type 3 (WPV3) was last detected in November 2012 in Nigeria. WPV1 is the only serotype that is endemic and that is in parts only of three countries (Afghanistan, Nigeria, and Pakistan). Four World Health Organization (WHO) regions (Americas, Europe, South-East Asia, and Western Pacific) are certified as polio-free by their respective Regional Certification Commissions (RCCs). Globally, reported WPV1 cases decreased from 74 in 2015 to 37 in 2016; in 2017, six WPV1 cases were reported as of mid-June (*4*).

The predominant risk associated with PV2 after Sabin type 2 withdrawal is the emergence of type 2 circulating vaccine-derived poliovirus (cVDPV2). Since Sabin type 2 withdrawal, GPEI has responded to the emergence or continued transmission of cVDPV2 in Democratic Republic of Congo, Nigeria, Pakistan, and Syria. Large-scale mOPV2 campaigns were conducted in these countries and the Lake Chad basin countries (*5*). Additional PV2 risks include immunodeficient carriers of VDPV (iVDPV), containment breaches by facilities, and deliberate release and "de novo" generation of PV2. To minimize the risks for paralytic poliomyelitis associated with PV2, vaccination with the inactivated poliovirus vaccine (IPV) will be needed for the foreseeable future (*6*).

There are known sources of PV2 in laboratories and vaccine production facilities, and unknown sources, primarily in nonpolio laboratories, including large sample collections of materials collected for other public health or research purposes in areas and at times when PV2 was still circulating. The continuing need for IPV requires the maintenance and expansion of global capacity to produce IPV, which contains PV2 (as well as PV1 and PV3). Because IPV is produced by inactivating wild or attenuated (Sabin) vaccine strains, vaccine production facilities, including quality control laboratories, are a major potential source of live virus. Diagnostic and research laboratories will continue to be needed to ensure rapid diagnostic capacity and critical research on the development of new vaccines and diagnostic methods. In addition, nonpolio laboratories might store and manipulate specimens collected from communities during a period of endemic WPV2 transmission or use of Sabin type 2 vaccine in immunization programs.

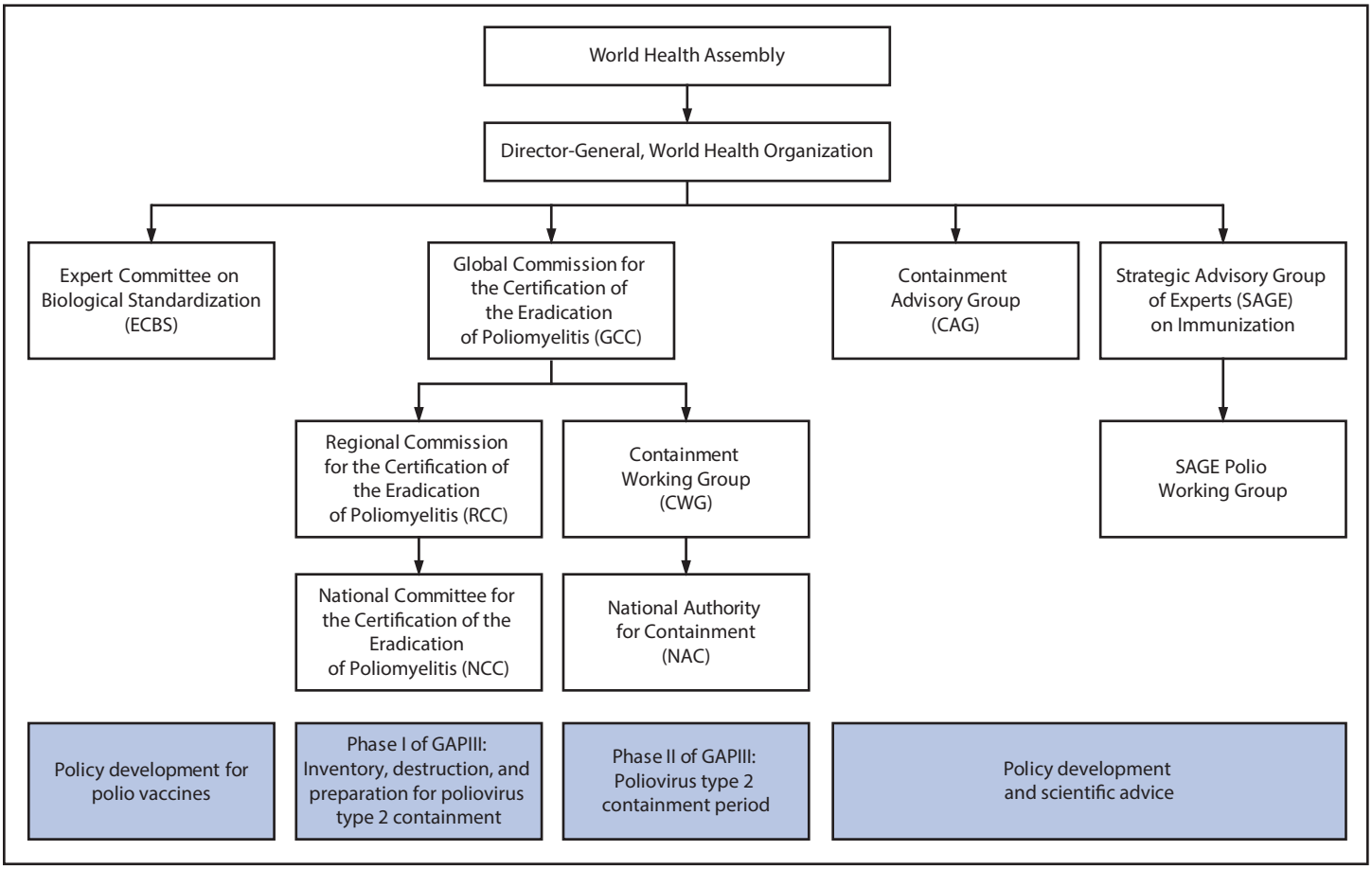
The Global Action Plan to Minimize Poliovirus Facility–Associated Risk After Type-Specific Eradication of Wild Polioviruses and Sequential Cessation of Oral Poliovirus Vaccine Use (GAPIII) (*7*), endorsed by the World Health Assembly in 2015, sets the stage for the implementation of containment work. GAPIII, including the annexes, provides the basis for drafting additional guidance documents, and can be revised as new information emerges relevant to achieving the appropriate balance between community risk and the systems and controls to manage that risk (*8*).

GAPIII divides containment work into three phases. Phase I addresses risks of WPV2 and cVDPV2, Sabin type 2 viruses, and potentially infectious materials in polio and nonpolio laboratories with the aim to "destroy, transfer, or contain" PV2 to eliminate or manage the risks. Phase II focuses on implementation of containment in poliovirus-essential facilities designated by countries to serve essential national or global functions, such as vaccine production, diagnostics, or research. Phase III will begin only after eradication of WPV1 and WPV3, and will focus on containment for all PVs.

The global oversight group for containment is GCC (*9*), which determined in 1995 that successful implementation of containment was a prerequisite for global certification. The containment activities in Phase I are overseen by National Certification Committees, which report to RCCs; they, in turn, report to GCC (Figure). Containment activities in Phase II are managed by the National Authorities for Containment (NACs), in consultation with the Containment Working Group, which reports directly to GCC. Technical and scientific issues related to GAPIII are addressed by the Containment Advisory Group. In the past, general containment issues were brought to the Strategic Advisory Group of Experts on Immunization (SAGE), which is the principal advisory group to WHO for vaccines and immunization.

The Expert Committee on Biologic Standardization (ECBS) is setting the standards for vaccine production and control to meet the quality standards and requirements for procurement by United Nations agencies. Technical Report Series 926, adopted in 2004, addresses the production and control of IPV in the containment era and is being revised for review and endorsement by ECBS in October 2018. The revised Technical Report Series 926 and GAPIII will be closely aligned. GCC, Containment Advisory Group, ECBS, and SAGE all report directly to the Director-General of WHO; the Director-General, in turn, reports to the World Health Assembly.

FIGURE. Organizational chart for groups involved in the worldwide containment of poliovirus type 2, including GAPIII* — World Health Organization



Abbreviation: GAP = Global Action Plan.

* WHO Global Action Plan to Minimize Poliovirus Facility–Associated Risk After Type-Specific Eradication of Wild Polioviruses and Sequential Cessation of Oral Poliovirus Vaccine Use. http://polioeradication.org/wp-content/uploads/2016/12/GAPIII_2014.pdf.

Phase I Progress

The basis for containment work is the national inventory of laboratories and vaccine production facilities that hold and plan to retain PV2 materials. Inventories of PV2 infectious materials were completed in all 194 WHO member countries and 21 territories, and reviewed by RCCs, but might require further scrutiny in some instances (e.g., in countries where mOPV2 has been deployed for outbreak response, inventories will need to be redone after the last campaign round).

All 146 laboratories in the Global Polio Laboratory Network (GPLN) had implemented Phase I activities as of July 31, 2016; as soon as PV2 is detected by these laboratories, the isolates are to be transferred to a poliovirus-essential facility for further processing and sequencing. All original samples and all derivatives with PV2 are to be stored under lock and key when the final results from sequencing become available.

Wild poliovirus type 2. Phase I inventories for WPV2 have been completed. Facilities holding WPV2 have been identified, all have implemented the "destroy, transfer, or contain" guidance, and some have been designated as poliovirus-essential facilities (Table).

cVDPVs and Sabin type 2. In Nigeria (and contiguous areas around Lake Chad), Democratic Republic of Congo, Pakistan, and Syria, cVDPV2 circulation required extensive use of mOPV2, which was also used in Mozambique after detection of VDPV2 in an area with low vaccination coverage. These detections and ensuing use of mOPV2 have delayed progress toward cVDPV2 and Sabin type 2 containment.

Potentially infectious materials. WHO is overseeing the development of guidance documents for potentially infectious materials, which will include a general introduction to containment for nonpolio laboratories, a hazard assessment guide that laboratories can use to determine the risk levels of their materials, and a document that outlines how to raise issues to the Containment Advisory Group. WHO plans to have the guidance documents endorsed by the Containment Advisory Group before the end of 2017.

Phase II Progress

Designation of poliovirus-essential facilities and establishment of National Authorities for Containment. By mid-June 2017, a total of 86 poliovirus-essential facilities had been designated in 30 countries (Table) by government authorities, including 21 (14.4%) of 146 GPLN laboratories. Eighteen of 30 countries with poliovirus-essential facilities had reported establishment of NACs to WHO. NACs, in consultation with the GCC Containment Working Group, will monitor the application process using three levels of certificates: certificate of participation, interim certificate of containment, and certificate of containment (*8*). The final authority for auditing facilities, and issuing these certificates, are NACs.

To support countries with designated poliovirus-essential facilities, WHO has conducted two series of training activities, including GAPIII implementation workshops since February 2015 and containment auditor workshops in 2017; these activities have been attended by 300 participants from all WHO regions.

Summary

What is already known about this topic?

Poliomyelitis eradication is nearing completion. To sustain eradication, vaccine production, diagnostic, and research facilities retaining polioviruses will have to ensure that these polioviruses are appropriately contained to minimize the risk for release into communities.

What is added by this report?

This report summarizes the progress toward implementation of the World Health Organization Global Action Plan for containment (GAPIII), achieved since the declaration of eradication of wild poliovirus type 2 in September 2015 and the withdrawal of Sabin type 2 poliovirus from the trivalent oral poliovirus vaccine in April 2016. Since then, the majority of countries decided not to retain poliovirus type 2, and 30 countries designated 86 poliovirus-essential facilities to address the critical needs for poliovirus vaccine production, disease diagnosis, and research.

What are the implications for public health practice?

Effective containment is a prerequisite for the global certification of poliomyelitis eradication. All countries have already compiled inventories of facilities with poliovirus. Countries planning to retain polioviruses are designating poliovirus-essential facilities, establishing national authorities for containment, and are expected to collaborate with the Global Commission for the Certification of the Eradication of Poliomyelitis on global containment oversight.

Discussion

The scope and complexity of PV containment work are considerable and will affect all 194 WHO member countries and 21 territories for decades to come. Containment of WPV2 is nearing completion, and cVDPV2 and Sabin type 2 containment are in progress, pending the control of cVDPV2 outbreaks. At the same time, issues related to facilities with potentially infectious materials are being addressed.

GPEI expects to achieve eradication of WPV1 in the near future. After global certification of WPV1 and WPV3 eradication, it is anticipated that all Sabin vaccines will be withdrawn, and no new seeding with Sabin viruses should occur. At that point, the world will enter the final stage of containment.

Because PV2 reintroduction into communities could reestablish endemic and epidemic poliovirus transmission,

TABLE. Facilities planning to retain poliovirus type 2 (PV2),* by World Health Organization (WHO) region, facility type, and PV2 strain†

WHO region	No. of countries	No. of facilities planning to retain PV2 materials	Type of PV2 materials retained and no. of facilities			No. of Salk-IPV production sites	No. of Sabin-IPV production sites§	No. of diagnostic or research laboratories
			WPV2	Both WPV2/ VDPV2 and OPV2/Sabin2	Only OPV2/ Sabin2			
AFR	2	2	0	2	0	0	0	2
AMR	5	27	3	20	4	1	1	25
EMR	2	2	0	0	2	0	1	1
EUR	14	32	5	24	3	8	2	22
SEAR	2	7	1	0	6	0	6	1
WPR	5	16	0	4	12	0	11	5
Total	**30**	**86**	**9**	**50**	**27**	**9**	**21**	**56**

Abbreviations: AFR = African Region; AMR = Region of the Americas; EMR = Eastern Mediterranean Region; EUR = European Region; IPV = inactivated polio vaccine; OPV = oral poliovirus vaccine; SEAR = South-East Asia Region; VDPV2 = type 2 vaccine–derived poliovirus; WPR = Western Pacific Region; WPV2 = type 2 wild poliovirus.
* Includes WPV2/circulating VDPV2 and OPV2/Sabin2.
† Data as of June 18, 2017.
§ Includes potential future producers in different clinical and preclinical phases of Sabin-IPV development.

it is critical for this risk to be reduced as close as possible to zero. Countries are aware of this threat and are attempting to decrease the number of facilities handling PV2. The spill of WPV2 in a production facility in the Netherlands in April 2017, infecting one operator, who, in turn, excreted this virus into the public sewage system (documented by environmental surveillance), highlights that the risk for containment breach is not a theoretical risk but something to be anticipated and planned for (*10*). The spill also emphasizes the need for appropriate facility-level biorisk management, incident response planning, and government oversight by NACs.

Conflict of Interest

No conflicts of interest were reported.

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References

1. Diop OM, Asghar H, Gavrilin E, et al. Virologic monitoring of poliovirus type 2 after oral poliovirus vaccine type 2 withdrawal in April 2016—worldwide, 2016–2017. MMWR Morb Mortal Wkly Rep 2017;66:538–42. https://doi.org/10.15585/mmwr.mm6620a4
2. Previsani N, Tangermann RH, Tallis G, Jafari HS. World Health Organization guidelines for containment of poliovirus following type-specific polio eradication—worldwide, 2015. MMWR Morb Mortal Wkly Rep 2015;64:913–7. https://doi.org/10.15585/mmwr.mm6433a5
3. Global Polio Eradication Initiative. Polio eradication and endgame strategic plan 2013–2018. Geneva, Switzerland: World Health Organization; 2013. http://polioeradication.org/who-we-are/strategy/
4. Morales M, Tangermann RH, Wassilak SG. Progress toward polio eradication—worldwide, 2015–2016. MMWR Morb Mortal Wkly Rep 2016;65:470–3. https://doi.org/10.15585/mmwr.mm6518a4
5. Nnadi C, Damisa E, Esapa L, et al. Continued endemic wild poliovirus transmission in security-compromised areas—Nigeria, 2016. MMWR Morb Mortal Wkly Rep 2017;66:190–3. https://doi.org/10.15585/mmwr.mm6607a2
6. World Health Organization. Meeting of the Strategic Advisory Group of Experts on immunization, October 2016—conclusions and recommendations. Wkly Epidemiol Rec 2016;91:561–82.
7. World Health Organization. WHO Global Action Plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use—GAPIII. Geneva, Switzerland: World Health Organization; 2015. http://www.polioeradication.org/wp-content/uploads/2016/12/GAPIII_2014.pdf
8. World Health Organization. Containment certification scheme to support the WHO Global Action Plan for Poliovirus Containment (GAPIII-CCS). Geneva, Switzerland: World Health Organization; 2017.
9. Global Commission for the Certification of Poliomyelitis Eradication. Summary of findings, decisions and recommendations. Presented at the 14th Meeting of the Global Commission for the Certification of Poliomyelitis Eradication, Bali, Indonesia; September 20–21, 2015.
10. European Center for Disease Control. Poliomyelitis-facility-related infection with WPV2—Netherlands. Communicable disease threats report. Week 16, April 16–22, 2017. Solna, Sweden: European Center for Disease Control; 2017. http://ecdc.europa.eu/en/publications/Publications/Communicable-disease-threats-report-22-apr-2017.pdf

Errata

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In "Notifiable Diseases and Mortality Tables," on pages ND403–22, weekly case counts were inadvertently omitted from the tables "Provisional cases of selected* infrequently reported notifiable diseases (<1,000 cases reported during the preceding year) — United States, week ending May 27, 2017 (21st week)†" and "Provisional cases of selected notifiable diseases (≥1,000 cases reported during the preceding year), and selected* low frequency diseases, United States and U.S. territories, weeks ending May 27, 2017, and May 28, 2016 (21st week).†" The updated Week 21 tables can be found at https://wonder.cdc.gov/ and at https://data.cdc.gov/.

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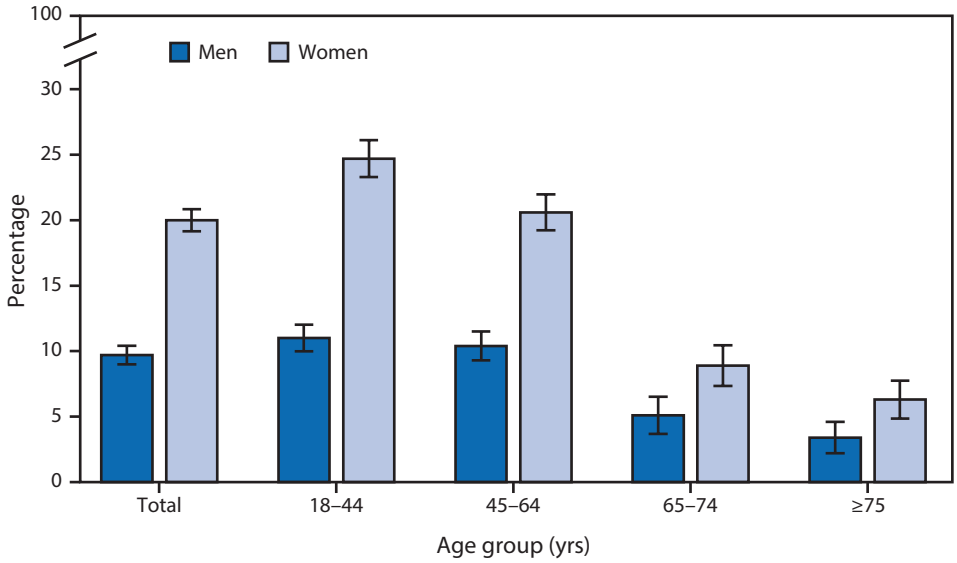
In the report "Japanese Encephalitis Surveillance and Immunization — Asia and Western Pacific Regions, 2016," on page 581, in the table "Characteristics of Japanese encephalitis (JE) surveillance in countries with JE virus transmission risk, 2016," and on page 582, in the table "Characteristics of Japanese encephalitis (JE) immunization programs in countries with JE virus transmission risk, 2016," Taiwan should have been indented beneath China. The corrected tables with added indents can be found at http://apps.who.int/iris/bitstream/10665/255639/1/WER9223.pdf.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Reported Having a Severe Headache or Migraine in the Past 3 Months,† by Sex and Age Group — National Health Interview Survey,§ United States, 2015



* With 95% confidence intervals indicated with error bars.
† Based on a positive response to the question "During the past 3 months, did you have a severe headache or migraine?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey Sample Adult component.

In 2015, 20.0% of women and 9.7% of men aged ≥18 years had a severe headache or migraine in the past 3 months. Overall and for each age group, women aged ≥18 years were more likely than men to have had a severe headache or migraine in the past 3 months. For both sexes, a report of a severe headache or migraine in the the past 3 months decreased with advancing age, from 11.0% among men aged 18–44 years to 3.4% among men aged ≥75 years and from 24.7% among women aged 18–44 years to 6.3% among women aged ≥75 years.

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

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