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Smoke-Free Policies in the World's 50 Busiest Airports — August 2017

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Exposure to secondhand smoke from burning tobacco products causes premature death and disease, including coronary heart disease, stroke, and lung cancer among nonsmoking adults and sudden infant death syndrome, acute respiratory infections, middle ear disease, exacerbated asthma, respiratory symptoms, and decreased lung function in children (*1*,*2*). The U.S. Surgeon General has concluded that there is no risk-free level of exposure to secondhand smoke (*1*). Previous CDC reports on airport smoke-free policies found that most large-hub airports in the United States prohibit smoking (*3*); however, the extent of smoke-free policies at airports globally has not been assessed. CDC assessed smoke-free policies at the world's 50 busiest airports (airports with the highest number of passengers traveling through an airport in a year) as of August 2017; approximately 2.7 billion travelers pass through these 50 airports each year (*4*). Among these airports, 23 (46%) completely prohibit smoking indoors, including five of the 10 busiest airports. The remaining 27 airports continue to allow smoking in designated smoking areas. Designated or ventilated smoking areas can cause involuntary secondhand smoke exposure among nonsmoking travelers and airport employees. Smoke-free policies at the national, city, or airport authority levels can protect employees and travelers from secondhand smoke inside airports.

The 50 busiest airports were identified using data from the Airport International Council, which lists airports based on total passenger traffic for 2016 (*4*). The Airport International Council defines passenger traffic as the sum of enplaned passengers, deplaned passengers, and direct-transit passengers. To determine the extent of smoke-free policies at each of the 50 busiest airports worldwide, CDC reviewed and analyzed public information available on airport websites regarding availability of designated indoor smoking rooms at airports as of August 2017. Results were confirmed with information on smoke-free airports maintained by Americans for Nonsmokers' Rights Foundation* and with other Internet resources, including information intended to assist smokers in finding places where smoking is permitted in airports. In a limited number of instances where airport websites contained unclear or ambiguous statements about policies, additional information was collected from other sources, including airport personnel and local public health personnel.

Airports were considered to have a smoke-free policy if they completely prohibit smoking in all indoor areas. Airports were considered to have no smoke-free policy if they allowed smoking in any indoor areas, including designated or ventilated indoor smoking areas. Designated smoking areas can include, but are not limited to, rooms designed for smoking tobacco; areas or rooms of restaurants or bars where smoking is allowed; and designated areas and rooms in airline clubs where smoking is allowed. Policy status was assessed overall and by global region.

* http://no-smoke.org/learnmore.php?id=187.

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Among the 50 busiest airports worldwide, 23 (46%) had a smoke-free policy (Table 1). Among the top 10 busiest airports, five had a smoke-free policy (Beijing Capital, Chicago's O'Hare International, London's Heathrow, Los Angeles International, and Shanghai Pudong International) and five allowed smoking in certain indoor areas (Atlanta Hartsfield Jackson International, Dubai International, Hong Kong International, Paris's Charles de Gaulle, and Tokyo International).

Regional differences were observed in smoke-free policy status among the world's 50 busiest airports (Table 2). Among those in North America, 14 of 18 had a smoke-free policy; in Europe, four of nine had a smoke-free policy, including airports in Madrid, Barcelona, and London (Heathrow and Gatwick airports); and in Asia, four of 22 had a smoke-free policy (all four are in China, including Beijing Capital International Airport, the world's second busiest airport). The only airport among the 50 busiest in Oceania is Sydney International, which is smoke-free. None of the world's 50 busiest airports is located in South America or Africa.

Discussion

As of August 2017, nearly half (46%) of the 50 busiest airports worldwide have a smoke-free policy. Smoke-free policies substantially improve indoor air quality and reduce secondhand smoke exposure among nonsmokers (*1*,*2*). The 2006 Surgeon General's report concluded that eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke, and that separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot eliminate exposure of nonsmokers to secondhand smoke (*1*).

Although the airports in this analysis that do not have smoke-free policies only allow smoking indoors in designated or ventilated smoking areas, studies have documented that secondhand smoke can transfer from designated smoking areas into nonsmoking areas in airports, where nonsmoking travelers and employees can be exposed (*5*–*7*). In addition to subjecting nonsmoking travelers who pass through these areas to involuntary secondhand smoke exposure, designated or ventilated smoking areas can also result in involuntary exposure of airport employees who are required to enter these areas or work near them.

Since 2012, two of the five large-hub U.S. airports that allowed smoking in designated indoor areas have implemented, or are implementing, smoke-free policies. Salt Lake City International, a large-hub U.S. airport that is not among the world's 50 busiest, closed its smoking rooms,[†] and Denver International closed three of its four indoor smoking rooms, with the final smoking room scheduled to close by 2018.[§]

The findings in this report are subject to at least three limitations. First, information on smoke-free policies was based on information available on airport websites, which could be subject to bias or be outdated. However, these data

[†] http://www.sltrib.com/news/3928480-155/salt-lake-city-to-phase-out; https://www.slcairport.com/airport-services/smoking-areas/.
[§] https://www.flydenver.com/sites/default/files/downloads/DIAPR_130111s.pdf.

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TABLE 1. Indoor smoke-free policy status of 50 busiest airports — worldwide, August 2017

Rank*	Airport	Jurisdiction	Country	Has indoor smoke-free policy†	Region
1	Atlanta-Hartsfield Jackson International	Atlanta	United States	No	North America
2	Beijing Capital International Airport	Beijing	China	Yes	Asia
3	Dubai International Airport	Dubai	United Arab Emirates	No	Asia
4	Los Angeles International Airport	Los Angeles	United States	Yes	North America
5	Tokyo International Airports	Tokyo	Japan	No	Asia
6	O'Hare International Airport	Chicago	United States	Yes	North America
7	Heathrow Airport	London	United Kingdom	Yes	Europe
8	Hong Kong International Airport	Hong Kong	Hong Kong	No	Asia
9	Shanghai Pudong International Airport	Shanghai	China	Yes	Asia
10	Charles de Gaulle Airport	Paris	France	No	Europe
11	Dallas/Forth Worth International Airport	Dallas/Fort Worth	United States	Yes	North America
12	Amsterdam Airport Schiphol	Amsterdam	Netherlands	No	Europe
13	Frankfurt Airport	Frankfurt	Germany	No	Europe
14	Istanbul Ataturk Airport	Istanbul	Turkey	No	Asia
15	Guangzhou Baiyun International Airport	Guangzhou	China	No	Asia
16	John F. Kennedy International Airport	New York City	United States	Yes	North America
17	Singapore Changi Airport	Changi	Singapore	No	Asia
18	Denver International Airport	Denver	United States	No	North America
19	Seoul Incheon International Airport	Incheon	Republic of Korea	No	Asia
20	Suvarnabhumi/New Bangkok International Airport	Bangkok	Thailand	No	Asia
21	Indira Gandhi International Airport	New Delhi	India	No	Asia
22	Soekarno-Hatta International Airport	Jakarta	Indonesia	No	Asia
23	San Francisco International Airport	San Francisco	United States	Yes	North America
24	Kuala Lumpur International Airport	Sepang District	Malaysia	No	Asia
25	Madrid-Barajas Airport	Madrid	Spain	Yes	Europe
26	McCarran International Airport	Las Vegas	United States	No	North America
27	Chengdu Shuangliu International Airport	Chengdu	China	No	Asia
28	Seattle-Tacoma International Airport	Seattle	United States	Yes	North America
29	Chhatrapati Shivaji International Airport	Mumbai	India	No	Asia
30	Miami International Airport	Miami	United States	Yes	North America
31	Charlotte Douglas International Airport	Charlotte	United States	Yes	North America
32	Toronto Pearson International Airport	Toronto	Canada	Yes	North America
33	Barcelona-El Prat Airport	Barcelona	Spain	Yes	Europe
34	Phoenix Sky Harbor International Airport	Phoenix	United States	Yes	North America
35	Gatwick Airport	London	United Kingdom	Yes	Europe
36	Taiwan Taoyuan International Airport	Taipei	Taiwan	No	Asia
37	Munich Airport	Munich	Germany	No	Europe
38	Sydney International Airport	Sydney	Australia	Yes	Oceania
39	Kunming International Airport	Kunming	China	No	Asia
40	Shenzhen Bao'an International Airport	Bao'an	China	Yes	Asia
41	Orlando International Airport	Orlando	United States	Yes	North America
42	Leonardo da Vinci–Fiumicino Airport	Rome	Italy	No	Europe
43	George Bush Intercontinental Airport	Houston	United States	Yes	North America
44	Mexico City International Airport	Mexico City	Mexico	No	North America
45	Shanghai Hongqiao International Airport	Shanghai	China	Yes	Asia
46	Newark Liberty International Airport	Newark	United States	Yes	North America
47	Ninoy Aquino International Airport	Manila	Philippines	No	Asia
48	Narita International Airport	Narita	Japan	No	Asia
49	Minneapolis/St Paul International Airport	Minneapolis/St Paul	United States	Yes	North America
50	Hamad International Airport	Doha	Qatar	No	Asia

* Ranked by total 2016 passenger traffic, according to the Airports Council International.
† Airports are considered to have a smoke-free policy if they completely prohibit smoking in all indoor areas. Airports were considered to have no smoke-free policy if they allowed smoking in any indoor areas, including designated or ventilated indoor smoking areas.

TABLE 2. Smoke-free airports among the 50 busiest airports, by region — worldwide, August 2017

Region*	No. (%) of airports among 50 busiest	No. (%) of airports with indoor smoke-free policies†
Asia	22 (44)	4 (18)
Europe	9 (18)	4 (44)
North America	18 (36)	14 (78)
Oceania	1 (2)	1 (100)
Total	**50 (100)**	**23 (46)**

* No airports among the world's 50 busiest were in the Africa or South America regions.
† Airports are considered to have a smoke-free policy if they completely prohibit smoking in all indoor areas. Airports were considered to have no smoke-free policy if they allowed smoking in any indoor areas, including designated or ventilated indoor smoking areas.

were cross-checked with secondary information sources, and questions about unclear information were resolved by contacting local public health and airport personnel. Second, it was not possible to identify the types of smoking areas that were allowed in all airports (e.g., rooms used exclusively for smoking, smoking sections in restaurants and bars, rooms or areas in airline clubs, etc.), nor was it possible to ascertain passenger or employee movement through airports, which might or might not include use of or proximity to areas where smoking is permitted. In addition, because it was not possible to identify smoke-free policies in outdoor areas or areas near exits, this information was not reported. Finally, only the 50 busiest airports were included in this study; therefore, regions such as South America and Africa were not represented in the study because they did not include any of these busiest airports. However, many airports with lower passenger volume have implemented smoke-free policies (*8*).

Progress has been made in protecting nonsmoking passengers and employees from secondhand smoke in airports. A majority of airports are smoke-free in many countries worldwide, including Australia and New Zealand; European countries such as Denmark, Ireland, Norway, Spain, and the United Kingdom; South American countries such as Argentina, Brazil, Chile, Ecuador, and Uruguay; and North American countries such as Canada and the United States.¶ Smoke-free policies at the national, city, or airport authority levels can protect employees and travelers from secondhand smoke inside airports.

¶ http://no-smoke.org/pdf/Smokefree-Airport-Highlights-From-Around-the-World.pdf.

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Summary

What is already known about this topic?

There is no risk-free level of exposure to secondhand smoke. Eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke. An overwhelming majority of large-hub airports in the United States prohibit smoking indoors.

What is added by this report?

Among the 50 busiest airports worldwide, 23 airports (46%), including five of the 10 busiest airports, prohibit smoking in all indoor areas. While smoke-free airports among the 50 busiest are common in North America (14 of 18), few airports in Asia (4 of 22) have implemented smoke-free polices.

What are the implications for public health practice?

Broader implementation of smoke-free policies at the national, city, or airport authority levels can protect employees and travelers of all ages from secondhand smoke inside airports.

Conflict of Interest

No conflicts of interest were reported.

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CDC Grand Rounds: Improving the Lives of Persons with Sickle Cell Disease

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Approximately 100,000 Americans have sickle cell disease (SCD), a group of recessively inherited red blood cell disorders characterized by abnormal hemoglobin, called hemoglobin S or sickle hemoglobin, in the red blood cells. Persons with hemoglobin SS or hemoglobin Sß^0 thalassemia, also known as sickle cell anemia (SCA), have the most severe form of SCD. Hemoglobin SC disease and hemoglobin Sß$^+$ thalassemia are other common forms of SCD. Red blood cells that contain sickle hemoglobin are inflexible and can stick to vessel walls, causing a blockage that slows or stops blood flow. When this happens, oxygen cannot reach nearby tissues, leading to attacks of sudden, severe pain, called pain crises, which are the clinical hallmark of SCD. The red cell sickling and poor oxygen delivery can also cause damage to the brain, spleen, eyes, lungs, liver, and multiple other organs and organ systems. These chronic complications can lead to increased morbidity, early mortality, or both. Tremendous strides in treating and preventing the complications of SCD have extended life expectancy. Now, nearly 95% of persons born with SCD in the United States reach age 18 years (*1*); however, adults with the most severe forms of SCD have a life span that is 20–30 years shorter than that of persons without SCD (*2*).

Pediatric Advances in Care and Continued Challenges

Most of the morbidity and mortality among pediatric patients with SCD is associated with pneumococcal sepsis, strokes, and pain crises. In 1986, researchers concluded that oral penicillin prophylaxis should start at age 4 months for children with SCA, because of the high rates of morbidity and mortality associated with sepsis in early childhood, and that screening for SCD should take place in the neonatal period (*3*). As a result, since 2006, newborns are universally screened for SCD in all U.S. states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands (*4*). Current recommendations for pneumococcal infection prevention also include a series of pneumococcal vaccines (*5*). Infarctive strokes occur in 11% of children with SCA (*6*). In 1992, transcranial Doppler ultrasonography was found to predict which children with SCD had the highest risk for developing a stroke (*7*). A few years later, a study demonstrated that chronic blood transfusions lowered the risk for first stroke in children with an abnormal transcranial Doppler (TCD) result by 92% (*8*). The current clinical recommendations are annual screening with TCD for children ages 2–16 years with SCA and, in an effort to prevent stroke, referral of children with abnormal TCD results to a chronic transfusion specialist (*5*).

Increased access to and utilization of health care services by children with SCD is a key component in decreasing morbidity and mortality. However, recent data from the Maryland Medicaid program found that 38% of children with SCD had not seen a hematologist by age 2 years, and 54% of children aged 12–17 years had not seen a hematologist in 2 years, suggesting that "the ambulatory care of many Medicaid-insured children with SCD might be inadequate" (*9*). Furthermore, although it is known that bone marrow transplantation is a promising cure for SCD, with 93% survival and 91% event-free survival after 5 years of follow-up, only 1,000 patients with SCD worldwide have received an HLA-identical sibling transplant (*10*). These findings indicate that, although gains have been made in the treatment of children with SCD, room for improvement remains.

The Transfer from Pediatric to Adult Care and Continued Challenges

As persons living with SCD age, issues concerning adherence, treatment, complications, and the health care system become different from those encountered during childhood. With so many variables in play, difficulty often occurs in determining the correlation between these factors and the changes in health status that can take place during and after the transfer from pediatric to adult care. Adolescence, in particular, represents a period of medical vulnerability for persons with SCD, given competing demands of normalcy with peers, increasing autonomy in self-management, and advancing disease. For example, Medicaid data suggest that the period of transition from pediatric to adult care is associated with a rise in complications, including pain crises, pulmonary complications, and use of emergency departments (*9*,*11*). The causes of these increased complication rates are multifaceted and include lack of access to qualified health care providers with an understanding and interest in SCD, changes in insurance coverage, psychosocial factors, and others.

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

Hydroxyurea is a chemotherapeutic agent that increases the production of fetal hemoglobin and decreases SCD-related complications. In adults with SCA, the annual rate of painful crises was significantly less frequent, and the median times to both first and second crises were longer in patients receiving hydroxyurea than in those receiving placebo (*12*). Hydroxyurea use was also found to lower the occurrence of acute chest syndrome (a vaso-occulsive crisis of the pulmonary vasculature) and the need for transfusion therapy. Hydroxyurea is currently labeled for use in adults but is also prescribed to children with SCA. Although hydroxyurea might reduce the occurrence of SCD-related issues, the burden of chronic organ damage remains increasingly important. Contemporary data indicate chronic organ damage is now the leading cause of death for adults with SCD (*13*).

Most adults with SCD have health care insurance, usually Medicaid or Medicare, or both. Still, gaps in coverage might preclude their accessing care. For example, insurance plans might not cover necessary services or high deductibles might preclude use of services. Intermittent or sporadic coverage can occur because of loss of a job that provided insurance or gain of a job that provides a level of income resulting in ineligibility for income-based programs. This lack of access to expert providers and care can further complicate a patient's disease course. As with the pediatric SCD population, broad opportunity exists for a multistrategy approach to improve health outcomes for adults with SCD.

A Health Policy Approach

Increasingly, health policy makers advocate the Triple Aim as a model for improving population health (*14*). The first aim is to improve population health, the second is to enhance patient experience, and the third is to reduce health care costs through eliminating preventable acute care utilization and readmissions. With the Triple Aim as the goal, researchers and policy makers are now trying to determine a way to achieve these aims for the SCD community that aligns with current health care priorities and occurs at the individual, provider, and health care system levels. Insufficient data, however, have limited recent efforts to incorporate SCD into health policy initiatives. For example, Healthy People 2020 contained 10 new objectives focused on sickle cell disease (BDBS-1–10); however, all were "archived due to lack of a viable data source" (*15*).

A Community Approach

The only national community-based organization for SCD, the Sickle Cell Disease Association of America (SCDAA), focuses on improving the quality of life of persons with SCD and finding a cure. SCDAA initiatives include advocacy for increased access to high-quality health care across the lifespan, increased drug development and therapeutic interventions to decrease disease-related complications, and increased availability of low-risk cures for all persons with SCD. To accomplish these goals, SCDAA developed Get Connected, an information-sharing, patient-powered registry. Through this web-based platform, multiple stakeholders can receive information important to the sickle cell community, such as new therapies, opportunities for enrollment in clinical trials, research results, and the locations of knowledgeable providers. The database and network include children and adults with SCD, families, community members, community-based organizations, health care providers, and government and private industry stakeholders.

A Public Health Approach

The shortage of long-term follow-up programs, registries, or data collection systems has limited the understanding of SCD. To address this gap in knowledge, in 2015, CDC implemented the Sickle Cell Data Collection program to address the need for this public health approach of improving health outcomes. Using state-based surveillance systems, the program provides important population-level data about disease course and the impact of interventions, health care use, and premature death and identifies providers and sites of care. Understanding the onset and progression of complications helps when planning strategies for prevention, early detection, and intervention. The four main objectives of the Sickle Cell Data Collection program are to 1) establish a health profile of the SCD population in the United States; 2) track changes in the SCD population's outcomes over time; 3) ensure that the SCD community has credible, scientifically sound information to inform standards of care; and 4) inform policy and health care changes. By achieving these goals, the program could improve quality of life, life expectancy, and health of persons living with SCD.

Without data and mechanisms to track and understand SCD care and outcomes, evidence of what works and where improvements could be made is limited. These two current efforts, Get Connected and the Sickle Cell Data Collection program, along with adequate resources and support, have the potential to provide the evidence base to inform health care policies and improve the lives of persons living with SCD.

Conflict of Interest

No conflicts of interest were reported.

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Public Health Economic Burden Associated with Two Single Measles Case Investigations — Colorado, 2016–2017

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During July 2016–January 2017, two unrelated measles cases were identified in the Denver, Colorado area after patients traveled to countries with endemic measles transmission. Each case resulted in multiple exposures at health care facilities and public venues, and activated an immediate and complex response by local and state public health agencies, with activities led by the Tri-County Health Department (TCHD), which serves Adams, Arapahoe, and Douglas counties. To track the economic burden associated with investigating and responding to single measles cases, personnel hours and supply costs incurred during each investigation were tracked prospectively. No secondary cases of measles were identified in either investigation. Postexposure prophylaxis (PEP) was administered to 31 contacts involving the first case; no contacts of the second case were eligible for PEP because of a delay in diagnosing measles disease. Public health costs of disease investigation in the first and second case were estimated at $49,769 and $18,423, respectively. Single measles cases prompted coordinated public health action and were costly and resource-intensive for local public health agencies.

Patient A

On July 9, 2016, a male resident of Arapahoe County aged 14 months experienced a fever, with cough, coryza, and conjunctivitis reported during the subsequent 3 days. On July 12, the child developed a diffuse macular rash on the head that spread to the torso and legs. The child was evaluated by a pediatrician, who suspected hand-foot-mouth (Coxsackievirus) disease because of the presence of an ulcer in the oropharynx. The child had visited the pediatrician for pretravel counseling at age 10 months, before visiting India during March 30–June 30; however, measles-mumps-rubella (MMR) vaccine had not been administered.* The child was seen by a pediatrician again on July 13 and 14 with persistent fever, respiratory symptoms, and rash, along with lethargy and anorexia. The pediatrician referred the child to a local hospital emergency department on July 14. Upon evaluation, the child was transferred and admitted to a pediatric hospital. On hospital admission, the child's temperature was 99.1°F (37.3°C) and a maculopapular rash on the face, neck, and trunk was noted, as well as buccal mucosal lesions. Subsequently, these buccal lesions were identified as Koplik spots by a consulting infectious disease specialist. However, there was a delay of approximately 5 hours before the child was moved to an airborne isolation room.

The following day (July 15), TCHD was notified of the suspected measles case and recommended that the child remain in airborne isolation during the remainder of the potential infectious period, 4 days after rash onset (i.e., through July 16). TCHD promptly activated their Public Health Incident Management Team to coordinate an urgent case investigation that involved contact identification, exposure assessment, and administration of PEP when appropriate, to prevent additional measles cases. The investigation required recruitment of public health investigators from TCHD and other state and local public health agencies in the Denver metropolitan area and assistance from hospital infection prevention specialists. Measles diagnosis was confirmed in the patient on July 16 by detection of measles virus by real-time polymerase chain reaction (PCR) from a nasopharyngeal swab specimen collected early on July 15; a positive measles immunoglobulin M (IgM) antibody titer was reported on July 20.

The patient's period of infectivity, defined as 4 days before until 4 days after rash onset, extended from July 8 to 16. Potential exposures occurred at eight settings. Five settings (three health care facilities, an apartment building, and a children's math and reading center) were deemed higher risk, based on exposure duration and proximity, and three (a supermarket, a large retail store, and a fast-food restaurant) were considered lower risk. A total of 311 possible contacts were evaluated from the higher risk settings. Among the 311 interviewed contacts, 283 (91%) were determined to have been potentially exposed and were evaluated for measles immunity (Table 1). According to the Advisory Committee for Immunization Practices (ACIP) recommendations for ascertaining presumptive immunity, persons who were born before 1957, had laboratory confirmation of immunity or prior measles disease, or had documentation of age-appropriate MMR vaccination were classified as immune (*1*). In addition, for this investigation, self-report of

*The Advisory Committee for Immunization Practices recommends routine childhood vaccination using measles-mumps-rubella (MMR) vaccine, with the first dose at age 12–15 months, and the second dose at age 4–6 years or at least 28 days after the first dose. International travelers aged ≥6 months are recommended to receive the MMR vaccine before travel.

TABLE 1. Immunity status and public health response for contacts of two index measles cases — Colorado, 2016–2017

Immune status	Public health response	No. (%) Patient A contact	No. (%) Patient B contact
Immune	No action	244 (100)	161 (100)
	Subtotal	244	161
Susceptible	IG PEP with weekly follow-up*	22 (69)	0 (0)
	MMR vaccine PEP with weekly follow-up	9 (28)	0 (0)
	Quarantine† with daily follow-up	1 (3)	1 (33)
	Exclusion from work for 21 days after exposure§	0 (0)	2 (67)
	Subtotal	32	3
Unknown	Weekly telephone follow-up	6 (86)	39 (57)
	Unable to contact; letters mailed if address known	1 (14)	20 (29)
	Out of state resident¶	0 (0)	9 (13)
	Subtotal	7	68
Total contacts		**283**	**232**

Abbreviations: IG = immune globulin; MMR = measles-mumps-rubella vaccine; PEP = postexposure prophylaxis.
* One person who received IG PEP could not be contacted for weekly follow-up.
† Self-isolation at home.
§ One health care worker with receipt of one documented MMR vaccine dose and an equivocal measles Immunoglobulin G test, and one contact with a negative Immunoglobulin G titer were excluded from work.
¶ Information regarding these nine contacts was sent to relevant health departments that were responsible for follow-up.

prior measles disease or MMR vaccination was used to classify persons as immune. Persons who were unable or unwilling to provide laboratory confirmation of immunity or were unsure about their measles disease or MMR vaccination history were classified as having unknown immunity, and persons who reported no previous receipt of MMR vaccine or measles disease were classified as susceptible. On the basis of these criteria, 244 (86%) of 283 potentially exposed persons were considered to be immune, seven (2%) had unknown immunity, and 32 (11%) were susceptible.

During the 45-hour period after initiating the contact investigation, TCHD held two clinics to dispense PEP. PEP with MMR vaccine is recommended to prevent disease in exposed susceptible persons if exposure occurred within the preceding 72 hours, or with immune globulin (IG) if exposure occurred within 6 days and the susceptible person is at risk for severe illness from measles, which includes infants, pregnant women without measles immunity, or persons with severe immune system compromise. Among 32 susceptible contacts, 31 (97%) received PEP, including nine (28%) who received MMR vaccine and 22 (69%) who received IG (including two immunocompromised children and 15 infants aged <6 months). One susceptible contact was identified too late to receive PEP and was voluntarily quarantined at home and monitored daily for symptoms until the end of the incubation period. Susceptible contacts who received PEP and contacts with unknown immunity were monitored weekly for 21 days, the maximum incubation period.

To alert the public about the potential that lower risk exposures might have occurred in community settings, TCHD issued a press release on July 18 that advised anyone who had been in the facilities visited by the index patient during the period of infectivity to request MMR vaccination if they were not already immune to measles and to watch for symptoms.

No secondary cases of measles were identified among contacts, nor were any other cases of measles reported in Colorado within 4 months of the index case. However, an infant contact aged 8 months who had received MMR vaccine PEP experienced fever of 102.2°F (39°C) and diarrhea on July 20, 4 days after vaccination and 7 days after being exposed to the index patient. A maculopapular rash was reported on the torso on July 23 (7 days after MMR vaccination) and the infant experienced anorexia and irritability on July 24. Because TCHD was already monitoring the infant for symptoms, the infant was placed in home quarantine, and a nasopharyngeal swab was collected for measles real-time PCR testing, which was reported positive on July 28. The nasopharyngeal swab specimen was sent to the Viral and Rickettsial Disease Laboratory at the California Department of Public Health, where the measles virus was identified as genotype A, the MMR vaccine strain, indicating the infant's febrile rash illness and positive measles real-time PCR was an adverse reaction to measles vaccine rather than a case of secondary transmission. In addition, the California Department of Public Health subsequently identified the measles genotype from the index patient as genotype B3, which is endemic in much of Africa and has been reported in India since 2012 (*2*).

Patient B

On January 7, 2017 (approximately 6 months after the case in patient A), a second, unrelated measles case in an unvaccinated male adult aged 33 years was reported to public health

in Denver, Colorado. The man had traveled to Thailand during November 20–December 14, 2016. The patient experienced a fever to 102.9°F (39.4°C) on December 20, followed by a coalescing macular rash on December 25, which started on the face, spread downward, and lasted for 8 days. The man was hospitalized during December 29–January 1; a blood sample collected on January 1 was reported as positive for measles IgM on January 6; TCHD was notified on January 7. During the infectious period (December 21–29), the patient visited 17 businesses and two health care facilities. The investigation protocol for patient A was used to classify contacts for patient B; however, in this investigation, contacts with only self-reported MMR vaccination were classified as having unknown immunity. Interviews with 248 possible contacts identified 232 (94%) who were potentially exposed and for whom measles immunity was assessed (Table 1). Among the 232 potentially exposed persons, three (1%) were susceptible to measles and either quarantined or excluded from work. Because public health was not notified of the case until >6 days from the time of exposure, PEP was not recommended. No secondary cases were identified.

TCHD prospectively tracked costs associated with these case investigations (Table 2). Personnel hours spent on the investigation were tracked in the agency's human resources system, and costs were calculated based on individual salaries. TCHD's nursing division provided costs for PEP supplies. Costs from external partners were requested and provided by each agency and stratified by personnel hours and supplies.

For the first measles case investigation, efforts spanned three public health agencies and two health care facilities with 756 hours of personnel time dedicated to the incident, at a cost of $49,769. For the second case investigation, three public health agencies managed the investigation, which required 435 personnel hours at a cost of $18,423.

TABLE 2. Financial and personnel costs associated with investigation of two measles cases — Colorado, 2016–2017

Public health costs	Patient A investigation	Patient B investigation	Both investigations
Agencies involved (no.)	5*	3†	5*
Personnel time (hrs)	756	435	1,191
Costs ($)			
Personnel time and support§	35,339	17,868	53,207
MMR vaccine PEP	336	0	336
IG PEP	12,464	0	12,464
Laboratory costs	1,630	555	2,185
Total costs	**49,769**	**18,423**	**68,192**

Abbreviations: IG = immune globulin; MMR = measles-mumps-rubella vaccine; PEP = postexposure prophylaxis.

* The Tri-County Health Department (TCHD), Denver Public Health (DPH), Colorado Department of Public Health and Environment (CDPHE), and two health care facilities.

† The TCHD, DPH, and CDPHE.

§ Personnel costs were calculated based on individual salaries multiplied by the number of hours spent on case investigation. TCHD included indirect costs. Only hours spent on public health investigation were included; other costs incurred at the hospital, including those related to direct patient care were not included. Personnel support costs included mileage and per diem. Personnel time estimates were tracked retrospectively for CDPHE.

Discussion

Measles is a highly infectious, vaccine-preventable viral disease that typically causes fever, cough, runny nose, conjunctivitis, and rash and can result in complications (otitis media, pneumonia, and encephalitis).

Endemic transmission of measles virus has not occurred in the United States since 2000 (*3*). U.S. outbreaks now typically occur when a traveler to a country with endemic measles transmission develops measles and the virus spreads in an undervaccinated community, amplifying the outbreak (*4*). A single case of measles prompts rapid case investigation, contact tracing, and use of PEP to prevent secondary transmission. Coordination from local and state public health agencies and health care facilities can improve timeliness of response and limit measles outbreaks.

This report highlights the high cost of public health response to measles introductions in local communities. Other published cost estimates of public health agency response to a single measles case range from $5,655 through $181,679 (*5–7*). Primary cost expenditures are personnel hours for contact tracing and coordination of PEP. The delay in reporting of patient B to public health precluded the use of PEP for contacts and resulted in lower costs. However, these missed opportunities for use of measles PEP could have led to secondary cases.

The cost estimates of these two case investigations are pure cost estimates, without consideration of cost effectiveness. This is a limitation because it results in an underestimate of the true economic burden of these public health investigations.

In addition to the direct costs from personnel hours, these investigations place considerable burden on public health agencies. For example, the investigation for Patient A required support from 41 TCHD staff members representing disease control, environmental health, nursing, communications, emergency preparedness, and administration. Reprioritization of public health programming during these urgent investigations has the potential to cause delay in delivering other necessary public health services.

A febrile rash with typical onset 7–12 days after MMR vaccination occurs in approximately one in 20 vaccine recipients (*8*) and can be confused with secondary measles transmission from an index patient. Viral genotyping is recommended to distinguish between wild-type measles virus infection and a vaccine reaction.

Summary

What is already known about this topic?

Measles is a highly contagious, vaccine-preventable viral infection that has been eliminated in the United States. However, U.S. outbreaks typically occur when an international traveler introduces the infection to an undervaccinated community. Effective interruption of the outbreak requires timely and comprehensive case investigation by public health agencies.

What is added by this report?

During July 2016–January 2017, two single, unrelated measles cases were diagnosed in the Denver metropolitan area, each exposing hundreds of persons, prompting a complex and coordinated response by multiple public health agencies, costing in excess of $68,000.

What are the implications for public health practice?

Increased awareness of the risk of travel-associated measles infection is needed. Prior to international travel, measles-mumps-rubella vaccination is recommended to prevent measles disease. Even a single case of measles can cause substantial economic and personnel burden to public health systems. This burden can be decreased by improving measles-mumps-rubella vaccination rates, increasing timely reporting of suspected or confirmed measles cases, and optimizing coordinated public health response.

Failure of clinicians to recognize measles early in the course of illness in these two cases serves as a reminder that health care providers might not be familiar with clinical measles or aware of the risk for measles transmission during international travel. Health care providers need to recommend MMR vaccination before travel when appropriate and maintain a high index of suspicion for measles in patients with a febrile rash illness, particularly unvaccinated returning international travelers. Because of ongoing measles transmission in other countries, importation into the United States will remain a threat. High population immunity, achieved through high 2-dose MMR vaccination coverage; prompt reporting of suspected measles cases to local public health agencies; and rapid diagnostic testing and implementation of local control measures are necessary to maintain measles elimination in the United States. Increased awareness by both clinicians and patients of international travel vaccination recommendations for measles is needed to prevent travel-associated measles infections. Even a single measles case can impose high economic and programmatic burdens on public health agencies.

Conflict of Interest

No conflicts of interest were reported.

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Progress Toward Poliomyelitis Eradication — Pakistan, January 2016–September 2017

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In 1988, the World Health Assembly launched the Global Polio Eradication Initiative. Among the three wild poliovirus serotypes, only wild poliovirus (WPV) type 1 (WPV1) has been detected since 2012. Since 2014, Pakistan, Afghanistan, and Nigeria remain the only countries with continuing endemic WPV1 transmission. This report describes activities conducted and progress made toward the eradication of poliovirus in Pakistan during January 2016–July 2017 and provides an update to previous reports (*1*,*2*). In 2016, Pakistan reported 20 WPV1 cases, a 63% decrease compared with 54 cases in 2015 *(3)*. As of September 25, 2017, five WPV1 cases have been reported in 2017, representing a 69% decline compared with 16 cases reported during the same period in 2016 (Figure 1). During January–September 2017, WPV1 was detected in 72 of 468 (15%) environmental samples collected, compared with 36 of 348 (9%) samples collected during the same period in 2016. WPV1 was detected in environmental samples in areas where no polio cases are being reported, which indicates that WPV1 transmission is continuing in some high-risk areas. Interruption of WPV transmission in Pakistan requires maintaining focus on reaching missed children (particularly among mobile populations), continuing community-based vaccination, implementing the 2017–2018 National Emergency Action Plan (*4*), and improving routine immunization services.

Immunization Activities

Based on United Nations Children's Fund (UNICEF) and World Health Organization (WHO) estimates, national vaccination coverage among infants with 3 doses of oral poliovirus vaccine (OPV [OPV3]) delivered through the routine immunization program was 72% in 2016, unchanged from 2014 and 2015 estimates (*5*). Administrative coverage with OPV3, calculated as the number of vaccine doses administered divided by the estimated target population, varied substantially by province.

Vaccination histories (based on immunization cards and parental recall) among children aged 6–23 months with acute flaccid paralysis (AFP) whose stool specimens tested negative for poliovirus (nonpolio AFP cases), are also used to estimate OPV coverage in target populations. The percentage of nonpolio AFP cases among children aged 6–23 months nationwide who had never received any OPV doses through routine immunization services or supplemental immunization activities (SIAs)* (i.e., zero-dose children) decreased from 2.1% in 2015 to 0.3% in 2016 and to 0.01% in 2017; the percentage who had received ≥4 OPV doses increased slightly from 96% in 2016 to 97% in 2017. The highest percentage of zero-dose children was recorded in the province of Balochistan during 2016 (3%) and 2017 (2%), and the lowest percentage was recorded in the province of Punjab (approximately 0% in both 2016 and 2017).

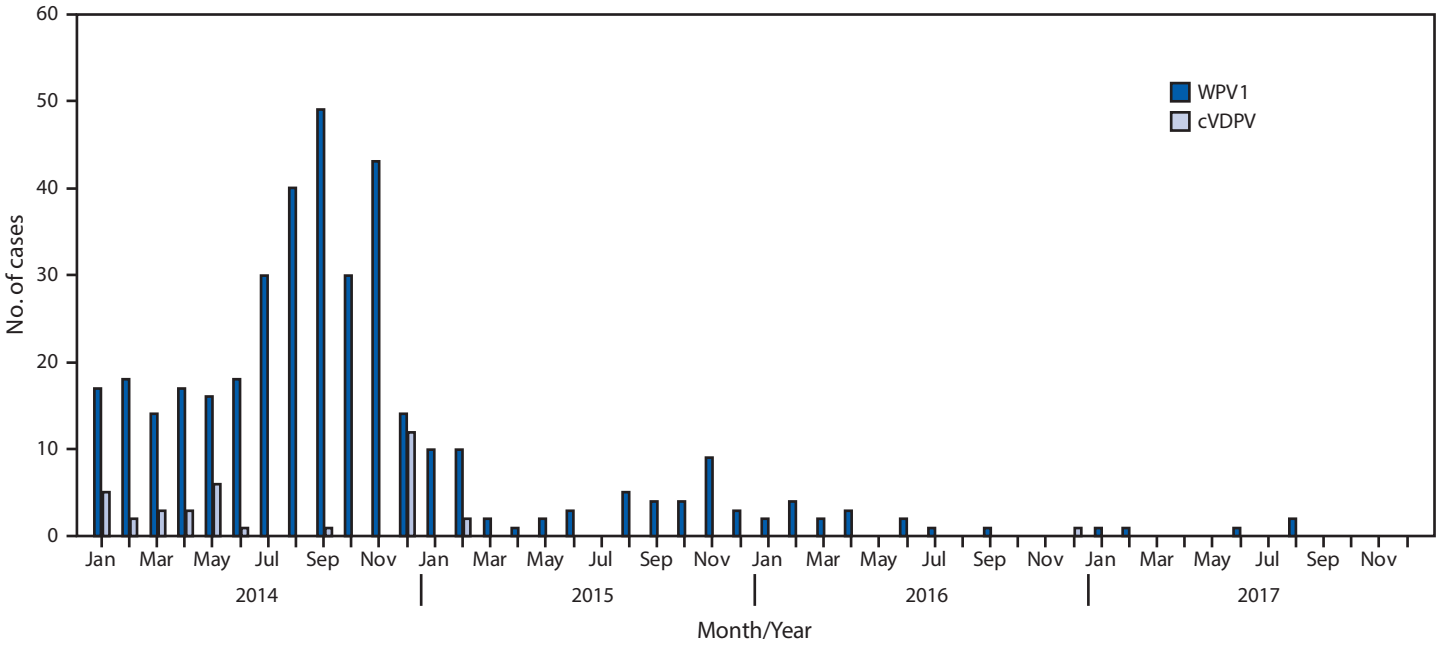
During January 2016–September 2017, 22 SIAs were conducted using bivalent OPV (bOPV; vaccine virus types 1 and 3), including eight full national immunization days and 14 subnational immunization days. To further boost the population immunity and enhance the prospects of interrupting of WPV transmission, injectable inactivated poliovirus vaccine (IPV) has been used in 10 SIAs conducted at fixed immunization posts since January 2016, reaching >9 million children in the provinces of Sindh, Federally Administered Tribal Areas (FATA), Balochistan, and Khyber Pakhtunkhwa.

During 2016, six SIAs using only IPV and targeting children aged <2 years were conducted in WPV1 core reservoir districts in Punjab, Khyber Pakhtunkhwa, FATA, Balochistan, and Sindh provinces. During the first two quarters of 2017, 14 SIAs (four national immunization days and 10 subnational immunization days), using both bOPV and IPV and targeting children aged <5 years, were conducted in the core polio reservoir districts in Khyber Pakhtunkhwa, FATA, Balochistan and Sindh. Administrative coverage with OPV3, calculated as the number of vaccine doses administered divided by the estimated target population, varied substantially by province.

In addition to SIAs, other initiatives have been established to help improve vaccination coverage in high-risk union councils (i.e., subdistricts) of the core polio reservoir districts. One initiative involves the use of community-based vaccinators to reach unvaccinated children in high-risk areas. Community-based vaccinators are recruited locally and focus on community engagement to vaccinate children on an ongoing basis, rather than solely during SIAs.

* Mass campaigns conducted for a brief period (days to weeks) in which 1 dose of oral poliovirus vaccine is administered to all children aged <5 years, regardless of vaccination history. Campaigns can be conducted nationally or subnationally (i.e., in portions of the country).

FIGURE 1. Number of cases of wild poliovirus type 1 (WPV1) and circulating vaccine derived poliovirus type 2 (cVDPV2), by month — Pakistan, 2014–2017



Surveillance Activities

AFP Surveillance. During 2016, a total of 7,847 AFP cases were reported in Pakistan; the highest number of cases was reported from the province of Punjab (3,939) and the lowest from the province of Gilgit-Baltistan (17) (Table). During 2016, the annual nonpolio AFP[†] rate per 100,000 population aged <15 years was 12.6 nationally, ranging from 2.5 to 30.7 among the seven provinces of Pakistan (Table). The percentage of AFP cases with adequate stool specimens[§] was 87.4%, ranging from 71% (Gilgit-Baltistan) to 94% (Islamabad). For 2017, the annualized national AFP rate was 13.9. The percentage of AFP cases with adequate stool specimens was 88% (provincial range = 85%–93%), and the minimum target of 80% stool specimen adequacy was met in all provinces.

Environmental Surveillance. Periodic testing of sewage samples for poliovirus at designated sites in the provinces of Punjab, Islamabad, Sindh, Khyber Pakhtunkhwa, and Balochistan supplements AFP surveillance. The number of environmental samples collected during January–September 2017 increased 34% compared with the same period in 2016. During January–September 2017, WPV was detected in 72 (15%) of 468 environmental samples from 53 sampling sites within 34 districts, compared with 36 (9%) of 348 environmental samples from 41 sampling sites during the same period in 2016.

In 2016, four environmental surveillance samples tested positive for circulating vaccine-derived poliovirus (cVDPV) type 2 (cVDPV2)[¶] in the province of Balochistan (one in the Pishin district in April 2016, and three in the Quetta district during March, April, and May 2016). No cVDPVs have been isolated from samples collected in 2017 to date.

WPV and VDPV Epidemiology

In 2016, Pakistan reported 20 WPV1 cases; as of September 25, 2017, five cases have been reported for 2017, representing a 69% decrease from the 16 cases reported during the same period in 2016. The WPV1 cases reported in 2017 occurred in Punjab, Gilgit-Baltistan, Sindh, Khyber Pakhtunkhwa, and Balochistan provinces. (Figure 2). During 2016, WPV1 cases were reported from 14 districts, compared with only five districts to date in 2017.

[†] Vaccination histories of children aged 6–23 months with acute flaccid paralysis who do not test WPV-positive are used to estimate OPV coverage of the overall target population and to corroborate national reported routine vaccination coverage estimates.

[§] AFP surveillance quality is monitored by performance indicators that include 1) the detection rate of nonpolio AFP cases and 2) the percentage of AFP cases with adequate stool specimens. WHO operational targets for countries with endemic poliovirus transmission are nonpolio AFP detection rates of ≥2 cases per 100,000 population aged <15 years and adequate stool specimen collected from ≥80% of AFP cases. Stool specimen adequacy is defined as two stool specimens collected ≥24 hours apart, both within 14 days of paralysis onset, and shipped on ice or frozen packs to a WHO-accredited laboratory, arriving in good condition (i.e., without leaks or desiccation) within 3 days.

[¶] VDPVs can cause paralytic polio in humans and have the potential for sustained circulation. VDPVs resemble WPVs biologically and differ from the majority of Sabin vaccine–related poliovirus isolates by having genetic properties consistent with prolonged replication or transmission.

TABLE. Acute flaccid paralysis (AFP) surveillance indicators and reported wild poliovirus (WPV) cases, by region and period — Pakistan, January 2016–September 2017

Region	AFP surveillance indicators (2016)			No. of reported WPV cases			
	No. of AFP cases	Nonpolio AFP rate*	% AFP cases with adequate stool specimens† shipped	Jan–Jun 2016	Jul–Dec 2016	Jan–Sep 2017	Total Jan 2016–Sept 2017
Pakistan overall	**7,847**	**12.6**	**87**	**13**	**7**	**5**	**25**
Punjab	3,939	9.7	89	0	0	1	**3**
Khyber Pakhtunkhwa	1,483	14.3	83	7	1	1	**13**
Sindh	1,483	8.5	89	4	4	1	**14**
FATA	482	30.7	86	1	1	0	**10**
Balochistan	305	8.2	86	1	1	1	**5**
Azad Jammu Kashmir	76	4.7	89	0	0	0	**0**
Islamabad	62	10.1	94	0	0	0	**0**
Gilgit-Baltistan	17	2.5	71	0	0	1	**1**

Abbreviation: FATA = Federally Administered Tribal Areas.
* Per 100,000 children aged <15 years (target: ≥2 cases per 100,000 population aged <15 years).
† Two stool specimens collected at an interval of at least 24 hours within 14 days of paralysis onset and properly shipped to the laboratory (target: 80% of AFP cases should have adequate stool specimens submitted).

All five WPV1 cases reported in 2017 occurred among children aged <36 months. Only one of these five children had never received a dose of OPV, compared with one of 14 WPV1 cases reported during January 2016–August 2016, and 12 (35%) of 34 WPV1 cases reported during the same period in 2015. A second WPV1 case in 2017 occurred in a child who had received no OPV through routine immunization services, but had received three OPV doses through SIAs.

Concomitant with the decrease in the number of WPV1 cases, transmission of several genetic lineages detected in 2015 was apparently interrupted during the reporting period, particularly during the second half of 2016 and first half of 2017 (*1*). WPV1 isolates from at least two main genetic clusters (groups of polioviruses sharing ≥95% sequence identity in the viral capsid protein VP1) have been detected during the 2016–2017 low transmission season by AFP surveillance, indicating continued circulation in the core reservoirs in the Sindh province and Quetta district. One case of paralysis associated with cVDPV2 was detected in the Quetta in 2016; no cVPDV2 cases have been detected in 2017 to date.

Discussion

During January 2016–September 2017, a total of 25 WPV1 cases were detected in Pakistan, representing a 64% decline, compared with the 69 cases reported the same period during 2015–2016 (*1*); WPV1-positive environmental surveillance samples increased 65%, associated with a 34% increase in sampling. Despite the sharp decline in WPV cases in 2017, at least three areas of continued transmission exist, as indicated by continuing isolation of WPV from environmental samples. The detection of WPV circulation through environmental surveillance in the absence of positive cases of AFP is concerning, because it suggests that some population groups might not be covered by existing AFP surveillance. Genomic sequence analysis provides additional evidence of remaining surveillance gaps in the country in 2017.

The intensified SIA schedule throughout Pakistan and the focus on identifying and immunizing previously unvaccinated children has been followed by a sharp decline in WPV cases in the country. In addition, the introduction and expansion of the community-based vaccinators initiative, which uses local

Summary

What is already known about this topic?

Pakistan remains one of three countries, along with Afghanistan and Nigeria, where wild poliovirus transmission has never been interrupted. Programmatic issues, insecurity, and population movement remain the main reasons for missing children during vaccination campaigns in all three countries. Core polio reservoirs of Pakistan have some of the lowest levels of routine immunization coverage in the world.

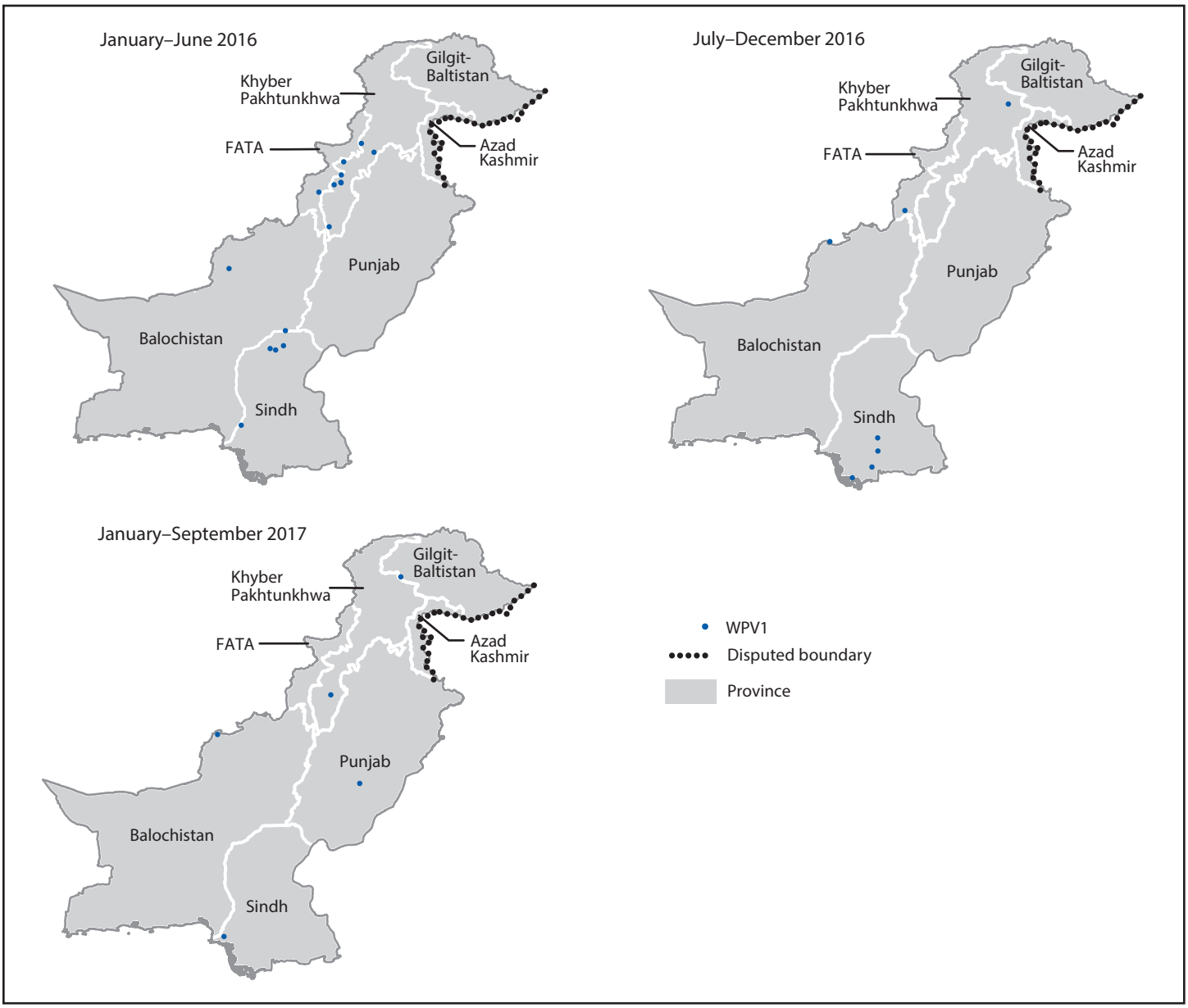
What is added by this report?

During January 2016–September 2017, wild poliovirus type 1 cases in Pakistan decreased 45% compared with the same period during 2015–2016. However, poliovirus-positive environmental samples were still detected in all core polio reservoirs of the country. During 2017, as of September, no circulating vaccine-derived poliovirus was detected in Pakistan.

What are the implications for public health practice?

Active poliovirus transmission in Pakistan continues to be a major challenge to the Global Polio Eradication Initiative. Interrupting poliovirus transmission in Pakistan requires 1) improving the quality of immunization campaigns, 2) strengthening polio surveillance, especially in areas with poliovirus-positive environmental samples, and 3) focus on common reservoir regions with Afghanistan.

FIGURE 2. Location of wild poliovirus type 1 (WPV1) cases — Pakistan, January 2016–September 2017



Abbreviation: FATA = Federally Administered Tribal Areas.

permanent vaccinators who possess the ability to build community trust, has helped to track and vaccinate children who are repeatedly missed during SIAs in high-risk areas, including those from underserved communities, such as seasonal laborers, nomadic families, and populations in transit, and including new birth cohorts.

During 2017, seven WPV1 cases have been reported through September in neighboring Afghanistan, one of the three remaining countries with endemic poliovirus transmission. Genetic sequencing of WPV1 isolates from these cases and from environmental samples indicate close genetic links to the WPV1 circulating in Pakistan. The epidemiology and genetic sequencing of WPV1 isolated during the reporting period indicate that the polio reservoirs continue to span the Pakistan-Afghanistan border and persist in at least three remaining areas in Pakistan. Ongoing challenges in the border areas include the large-scale movement of highly mobile population subgroups in two main poliovirus corridors (*6*). One of the two main geographic corridors extends from FATA and surrounding areas in Pakistan to the eastern region of Afghanistan, and the other from the Quetta block (Pishin, Killa Abdullah, and Quetta districts) of Balochistan province in Pakistan up to Kandhar

and Helmand provinces in southern Afghanistan. Despite these persistent challenges, polio eradication crossborder efforts between Afghanistan and Pakistan continue to improve, through regular meetings and information exchange between teams. Efforts to reach more of the unvaccinated children in the mobile population, coupled with an intense SIA schedule, must be sustained to interrupt WPV transmission in Pakistan.

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Conflict of Interest

No conflicts of interest were reported.

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Erratum

Vol. 65, No. 36

In the report "Vital Signs: Disparities in Antihypertensive Medication Nonadherence Among Medicare Part D Beneficiaries — United States, 2014," on page 973, in Table 3, the data for states beginning with "N" should have read as follows:

Table 3. Antihypertensive medication nonadherence among Medicare Part D beneficiaries aged ≥65 years, by state and territory, United States, 2014

		AHM fills				Annual AHM spending			
State/Territory	No. beneficiaries	Total (millions)	Mean maximum treatment intensity*	Percent fixed-dose combinations	Mean days' supply per fill	Total spending per beneficiary ($)	Out-of-pocket spending per beneficiary ($)	Percent of out-of-pocket spending attributed to AHM	Percent nonadherent†
Nebraska	108,367	1.49	2.20	8.7	46.4	302	111	17.9	22.6
Nevada	135,396	1.38	2.15	8.6	59.1	250	73	15.6	28.2
New Hampshire	66,971	0.71	2.10	5.2	60.4	285	99	18.6	20.5
New Jersey	532,767	5.49	2.22	11.2	60.5	472	117	21.5	25.3
New Mexico	103,182	1.06	2.08	7.0	56.9	261	77	17.9	29.8
New York	1,243,971	15.11	2.23	9.6	52.3	404	83	20.2	25.3
North Carolina	615,702	8.05	2.24	10.4	47.4	307	93	17.4	28.1
North Dakota	42,929	0.54	2.24	7.3	53.5	272	109	17.5	18.7

Abbreviation: AHM = antihypertensive medication.

* Mean of the maximum number of AHM classes on hand at any one time per beneficiary; proxy for blood pressure treatment intensity.

† Nonadherence is defined as patients not following their health care professional's instructions concerning taking their prescribed medication. Using the proportion of days covered methodology, beneficiaries were considered nonadherent if they had access to AHM for <80% of the days from the date of their first AHM fill through the end of 2014 or their death in 2014.

Erratum

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In the report "Trends in Repeat Births and Use of Postpartum Contraception Among Teens — United States, 2004–2015," on page 422, the last sentence of the second column should have read "Trends in postpartum contraceptive use were analyzed in 2-year increments **using statistical software** to account for the complex sampling design of PRAMS." In addition, the fourth footnote on page 422 should have read "¶ The thirty states (Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, **Missouri**, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming) and New York City are hereafter referred to as "states.""

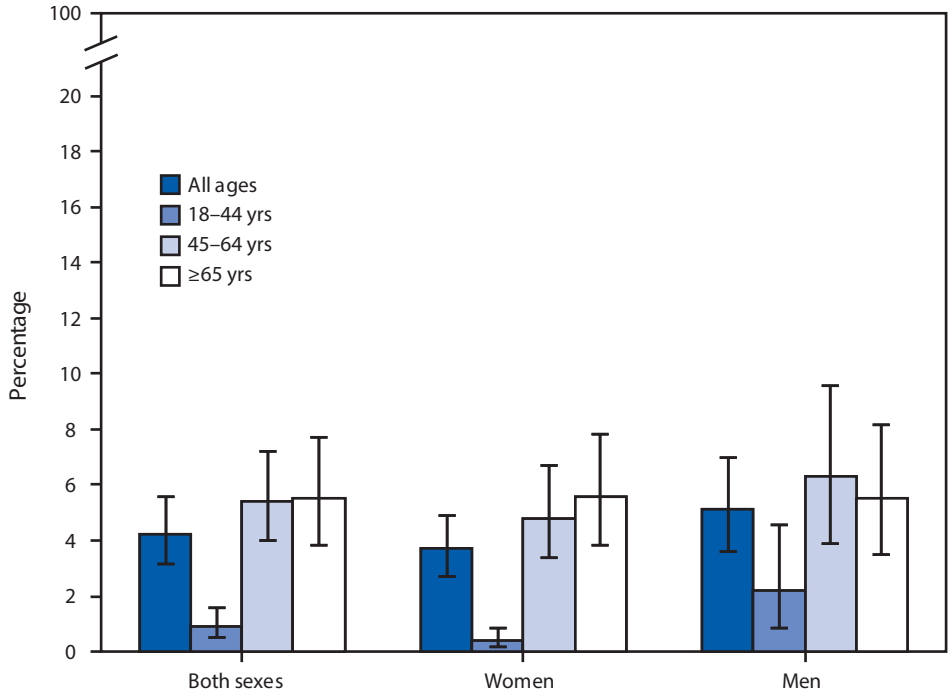
On page 423, the first sentence of the first paragraph under "Repeat Teen Births: 2015 and Change from 2004 to 2015," should have read "In 2015, among **228,862** births to teens aged 15–19 years, 38,324 (16.7%) were repeat births (Supplementary Table 1; **https://stacks.cdc.gov/view/cdc/45184**)."

On page 424, the second footnote of the Table should have read "† "States" refer to 30 states (Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, **Missouri**, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming) and New York City."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Visits to Office-Based Physicians† by Adults Aged ≥18 Years for Diabetes Mellitus,§ by Sex and Age — National Ambulatory Medical Care Survey, 2015



* With 95% confidence intervals indicated by error bars.
† Based on a sample of visits to nonfederally employed office-based physicians who are primarily engaged in direct patient care. Physicians in specialties of anesthesiology, pathology, and radiology are excluded from the survey.
§ Diabetes mellitus indicated by patient as one of the reasons for visit. National Ambulatory Medical Care Survey collects up to five reasons for visit.

In 2015, diabetes was a reason for 4.2% of visits by adults to office-based physicians. Men aged 18–44 years had a higher percentage of visits for diabetes compared with women aged 18–44 years (2.2% versus 0.4%, respectively). Both women and men aged 18–44 years had a lower percentage of visits for diabetes compared with adults aged 45–64 and ≥65 years.

Source: National Ambulatory Medical Care Survey, 2015 data. https://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm.

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