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National Diabetes Month — November 2015

November is National Diabetes Month. In the United States, approximately 29 million persons have diabetes, and an additional 86 million adults have prediabetes, putting them at risk for developing type 2 diabetes, heart disease, and stroke (*1*). Persons with diabetes can take steps to control the disease and prevent complications, and those with prediabetes can prevent or delay the onset of type 2 diabetes through weight loss, healthy eating, and physical activity (*1,2*). After decades of continued increases, the prevalence of diabetes changed little from 2007–2008 to 2011–2012 (*3*).

CDC and the American Medical Association has launched Prevent Diabetes STAT: Screen, Test, Act Today (http://www.preventdiabetesstat.org). This multiyear initiative includes a toolkit (http://www.cdc.gov/diabetes/prevention/pdf/STAT_toolkit.pdf) to help persons determine their risk for type 2 diabetes and to guide health care providers on the best methods to screen patients for prediabetes and refer patients at high risk to prevention programs. The CDC-led National Diabetes Prevention Program promotes diabetes prevention programs that focus on lifestyle changes in communities throughout the United States (*4*). More information about CDC-recognized diabetes prevention programs is available at https://nccd.cdc.gov/DDT_DPRP/Registry.aspx.

References

1. CDC. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services, CDC; 2014.
2. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346:393–403.
3. Menke A, Casagrande S, Geiss L, Cowie CC. Prevalence of and trends in diabetes among adults in the United States, 1988–2012. JAMA 2015;314:1021–9.
4. Albright AL, Gregg EW. Preventing type 2 diabetes in communities across the US. The National Diabetes Prevention Program. Am J Prev Med 2013;44(4 Suppl 4):S346–51.

Diabetes Among Asians and Native Hawaiians or other Pacific Islanders — United States, 2011–2014

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Asians and Native Hawaiians or other Pacific Islanders (NHPIs) are fast-growing U.S. minority populations[*,†] at high risk for type 2 diabetes (*1–4*). Although national studies have described diabetes prevalence, incidence, and risk factors among Asians (*2–5*) and NHPIs (*2,5*) compared with non-Hispanic whites, little is known about state-level diabetes prevalence among these two racial groups, or about how they differ from one another with respect to diabetes risk factors. To examine state-level prevalence of self-reported, physician-diagnosed (diagnosed) diabetes and risk factors among Asians and NHPIs aged ≥18 years, CDC analyzed data from the 2011–2014 Behavioral Risk Factor Surveillance System (BRFSS). Among five states and Guam with sufficient data about NHPIs for analysis, the age-adjusted diabetes prevalence estimate for NHPIs ranged from 13.4% (New York) to 19.1% (California). Among 32 states, the District of Columbia (DC), and Guam that had sufficient data about Asians for analysis, diabetes prevalence estimates for Asians ranged from 4.9%

* Available at https://www.census.gov/prod/cen2010/briefs/c2010br-11.pdf.
† Available at http://www.census.gov/prod/cen2010/briefs/c2010br-12.pdf.

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(Arizona) to 15.3% (New York). In the five states and Guam with sufficient NHPI data, NHPIs had a higher age-adjusted prevalence of diabetes than did Asians, and a higher proportion of NHPIs were overweight or obese and had less than a high school education compared with Asians. Effective interventions and policies might reduce the prevalence of diabetes in these growing, high-risk minority populations.

Diabetes is a major public health problem that disproportionately affects Asians and NHPIs (*1*–*4*). The higher rates of diabetes in these populations might reflect elevated genetic susceptibility, higher prevalences of risk factors such as obesity, physical inactivity, educational attainment, or a combination of these and other factors (*2*–*5*). Prevalences of diagnosed diabetes and associated risk factors were assessed using 2011–2014 BRFSS data. BRFSS is a state-based, random-digit–dialed, cellular and landline telephone survey of the U.S. civilian noninstitutionalized population aged ≥18 years, and is conducted in all 50 states, DC, Guam, Puerto Rico, and the U.S. Virgin Islands. The state-specific median response rate was 49.7% (range = 33.8%–64.1%) in 2011, 45.2% (27.7%–60.4%) in 2012, 46.4% (29.0%–60.3%) in 2013, and 47.0% (25.1%–60.1%) in 2014. Persons with reported diagnosed diabetes were defined as those who answered "yes" to the question: "Have you ever been told by a doctor that you have diabetes?" Data were combined for 2011–2014 to obtain overall U.S. estimates for non-Hispanic whites (whites), Asians, and NHPIs. State-specific estimates of diabetes prevalence with relative standard errors >30% or sample sizes <50 were not reported. Analyses were weighted to account for the complex sampling design.

For the states with sufficient data for both Asians and NHPIs, the distributions of diabetes risk factors and their proportions attributable to diabetes prevalence were estimated. These risk factors included age, sex, educational attainment, lack of leisure-time physical activity during the past month, and body mass index (BMI; kg/m^2) computed from respondents' self-reported weight and height (classified as normal weight [BMI <25.0], overweight [BMI = 25.0–29.9], and obese [BMI >29.9]). Data were age-adjusted using the 2000 U.S. standard population. Multivariate adjusted prevalence by race was estimated from logistic regression models predicting diabetes as a function of age, sex, educational attainment level, BMI, and physical inactivity (*6*). A chi-square test was used to determine whether differences between races in the distribution of diabetes risk factors were significant, and a t-test was used to determine whether differences in diabetes prevalence between races were significant (p<0.05 for both tests).

Thirty-two states, DC, and Guam had sufficient data to estimate diabetes prevalence among Asians, and five states (California, Hawaii, New York, Utah, and Washington) and Guam had sufficient data to estimate prevalence for NHPIs (Table 1). Across all states, the age-adjusted prevalence of diagnosed diabetes was higher among Asians (9.9%) and NHPIs (14.3%) than among whites (8.0%), (p<0.001 for both). In

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TABLE 1. Crude and age-adjusted prevalence of self-reported physician-diagnosed diabetes among Asians and Native Hawaiians or other Pacific Islanders (NHPIs) aged ≥18 years, in 32 states, the District of Columbia, and Guam* — Behavioral Risk Factor Surveillance System, United States, 2011–2014

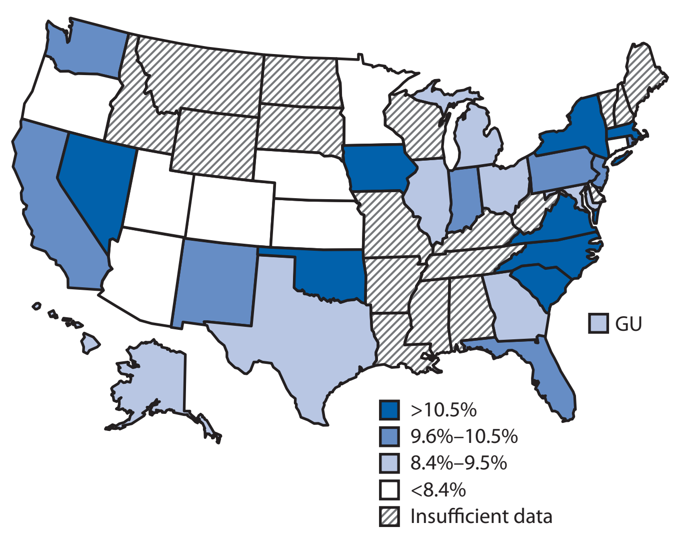
State/Territory	Race	No. of respondents	Crude prevalence % (95% CI)	Age-adjusted prevalence† % (95% CI)
Alaska	Asian	313	7.1 (4.5–11.1)	9.0 (5.6–14.3)
Arizona	Asian	108	3.4 (2.0–5.8)	4.9 (2.9–8.0)
California	NHPI	224	14.9 (9.7–22.3)	19.1§ (13.5–26.4)
	Asian	3,102	8.9 (7.7–10.3)	9.7 (8.4–11.1)
Colorado	Asian	589	5.2 (3.5–7.8)	7.1 (4.9 –10.1)
Connecticut	Asian	647	4.8 (3.3–7.0)	8.0 (5.6–11.3)
District of Columbia	Asian	351	2.8 (1.6–4.9)	5.1 (3.0–8.5)
Florida	Asian	661	7.6 (5.5–10.5)	10.2 (7.5–13.7)
Georgia	Asian	371	4.7 (2.8–7.6)	9.5 (6.0 –14.5)
Hawaii	NHPI	930	10.7 (8.4–13.6)	13.9§ (11.1–17.3)
	Asian	9,503	10.9 (10.1–11.8)	8.8 (8.0–9.6)
Illinois	Asian	520	5.7 (3.8–8.4)	9.0 (6.2–12.9)
Indiana	Asian	318	6.3 (3.9–10.2)	10.5 (6.5–16.6)
Iowa	Asian	230	5.2 (3.2–8.5)	11.4 (6.9–18.2)
Kansas	Asian	685	4.2 (3.0–6.0)	8.3 (6.0–11.5)
Maryland	Asian	965	7.1 (5.4–9.2)	9.1 (7.1–11.6)
Massachusetts	Asian	628	5.5 (4.1–7.3)	10.7 (7.9–14.3)
Michigan	Asian	470	4.9 (3.4–7.1)	9.1 (6.3–13.0)
Minnesota	Asian	892	3.8 (2.6–5.7)	6.2 (3.7–10.1)
Nebraska	Asian	455	4.3 (2.6–6.9)	6.9 (4.4–10.8)
Nevada	Asian	485	12.2 (8.8–16.8)	13.4 (10.0–17.7)
New Jersey	Asian	231	7.8 (6.4–9.5)	9.9 (8.1–11.9)
New Mexico	Asian	250	7.9 (5.0–12.3)	9.9 (6.5–14.7)
New York	NHPI	109	11.4 (6.2–20.1)	13.4 (7.5–22.7)
	Asian	1,126	11.2 (8.7–14.2)	15.3 (12.3–18.9)
North Carolina	Asian	394	5.9 (3.5–9.7)	11.3 (7.6–16.4)
Ohio	Asian	392	4.1 (2.3–7.2)	9.0 (5.3–14.7)
Oklahoma	Asian	300	7.8 (5.2–11.5)	11.0 (7.6–15.8)
Oregon	Asian	291	5.2 (3.3–8.1)	7.4 (4.8–11.4)
Pennsylvania	Asian	593	5.7 (3.6–8.8)	10.1 (6.9–14.4)
Rhode Island	Asian	294	4.5 (2.6–7.9)	9.7 (5.6–16.3)
South Carolina	Asian	254	8.8 (4.9–15.3)	12.1 (7.6–18.7)
Texas	Asian	1,048	5.5 (3.8–7.8)	8.8 (6.3–12.3)
Utah	NHPI	185	7.9§ (6.4–9.5)	18.6§ (11.6–28.7)
	Asian	546	4.0 (2.7–5.7)	6.4 (4.4–9.2)
Virginia	Asian	614	6.1 (4.3–8.7)	11.4 (8.3–15.4)
Washington	NHPI	202	14.2 (8.4–22.8)	17.8 (11.3–26.7)
	Asian	1,385	7.4 (6.0–9.1)	10.0 (8.3–12.1)
Guam	NHPI	2,923	13.5§ (12.0–15.3)	15.7§ (14.0–17.7)
	Asian	2,399	8.8 (7.4–10.3)	8.5 (7.3–10.0)
United States¶	NHPI	6,520	11.0§ (9.3–13.0)	14.3§ (12.1–16.7)
	Asian	37,098	7.8 (7.2–8.5)	9.9 (9.2–10.7)

Abbreviation: CI = confidence interval.
* Prevalence was not calculated for states with insufficient data (sample size <50, or a relative standard error >30%).
† Age-adjusted to the 2000 U.S. standard population.
§ Statistically significant difference exists between the two racial groups (p<0.05, by t-test).
¶ Prevalence in the United States includes all states regardless of state-specific sample size.

the 32 states, DC, and Guam, where sufficient data for analysis of prevalence among Asians were available, age-adjusted prevalence of diagnosed diabetes among Asians ranged from 4.9% in Arizona to 15.3% in New York, with eight states (Iowa, Kentucky, Massachusetts, Nevada, New York, North Carolina, Oklahoma, and South Carolina) in the highest quartile (>10.5%) of age-adjusted diabetes prevalence (Figure). Age-adjusted prevalences of diabetes for NHPIs exceeded 10.5% in all five states and Guam where sufficient data for analysis of NHPIs were available, ranging from 13.4% in New York to 19.1% in California (Table 1).

The age-adjusted prevalence of diabetes was significantly higher for NHPIs than Asians in California (19.1% versus 9.7%, p = 0.005), Hawaii (13.9% versus 8.8%, p = 0.001), Utah (18.6% versus 6.4%, p = 0.006), and Guam (15.7% versus 8.5%, p<0.001) (Table 1), but not in New York (13.4% versus 15.3%, p = 0.647) or Washington (17.8% versus 10.0%, p = 0.054).

FIGURE. Prevalence of self-reported diabetes* among Asians aged ≥18 years — Behavioral Risk Factor Surveillance System, United States, 2011–2014†



Abbreviation: GU = Guam.
* Answered "yes" to the question, "Have you ever been told by a doctor that you have diabetes?"
† Data were age-adjusted using the 2000 U.S. standard population.

Summary

What is already known on this topic?

Previous national studies have shown that the prevalence of diabetes among Asians and Native Hawaiians and other Pacific Islanders (NHPIs) is higher than that among non-Hispanic whites.

What is added by this report?

The national-level findings in this study are consistent with previous reports. However, this is the first study to provide state-specific prevalences of diabetes for Asians and NHPIs for those states and territory with sufficient data for analysis. For both state and national estimates, NHPIs had higher prevalences of diabetes than did Asians.

What are the implications for public health practice?

Diabetes is a major public health problem that disproportionately affects Asians and NHPIs. The state-specific data from this study could be used to create more effective interventions and policies to reverse the large diabetes burden in these growing, high-risk minority populations. Continued surveillance for diabetes and its risk factors among Asians and NHPIs is an important component in monitoring progress toward reducing their burden of diabetes.

When the data from California, Hawaii, New York, Utah, Washington, and Guam were combined, the distribution of diabetes risk factors varied between the two racial groups (Table 2). NHPIs were younger (p = 0.03), had lower educational levels (p<0.001), and higher BMIs (p<0.001) than Asians; differences by sex or prevalence of physical inactivity were not significant. When the prevalence of diabetes between the two groups was examined by risk factors, NHPIs had higher diabetes prevalences for persons in age groups 18–44 years (p = 0.006) and 45–64 years (p = 0.01) than did Asians. Age-adjusted diabetes prevalence was higher in NHPI females (p = 0.002) and persons who had less than or greater than a high school education (p = 0.002 and p = 0.02, respectively) (Table 2). Age-adjusted diabetes prevalence for physical inactivity or BMI did not differ between the two groups (Table 2).

Overall, after adjusting for age, NHPIs had a higher prevalence of diabetes than Asians (p = 0.001) (Table 2). However, after adjusting for diabetes risk factors (sex, age, BMI, education, and physical inactivity), the prevalence of diabetes for NHPIs and Asians was not significantly different.

Discussion

This report is the first to provide state-specific estimates of self-reported, diagnosed diabetes prevalence among Asians and NHPIs in the United States. During 2011–2014, among Asians, age-adjusted prevalence of diagnosed diabetes varied widely across states, with approximately a threefold difference between the state with the highest prevalence (New York, 15.3%) and the state with the lowest (Arizona, 4.9%). In six geographic areas with sufficient data to analyze diabetes prevalence among NHPIs, age-adjusted diabetes prevalence for NHPIs exceeded 13.0%; in three jurisdictions, approximately one in six NHPIs had diagnosed diabetes.

These findings are consistent with earlier studies that reported a higher prevalence of diabetes among Asians (*2–4*) and NHPIs (*2*) compared with whites in the United States, and a higher rate of diabetes in NHPIs than in Asians (*2,5*). This report found differences in the distribution of risk factors for diabetes between Asians and NHPIs in five U.S. states and one territory with sufficient data for both groups. NHPIs had higher BMIs and lower educational levels, both of which are important risk factors for diabetes (*7*). After adjusting for several risk factors, the difference in diabetes prevalence between Asians and NHPIs was no longer significant, suggesting that these risk factors might account for the difference.

The findings in this report are subject to at least five limitations. First, diabetes prevalence was measured by self-report and might be subject to recall and selection bias. Second, prevalence of diabetes might be underestimated because it has been shown that approximately one in four persons with diabetes has not received a diagnosis of diabetes.[§] Third, 18 states lacked

§ Available at http://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf.

TABLE 2. Prevalence of self-reported, physician-diagnosed diabetes, and the overall distribution of selected demographic characteristics and related risk factors among adult Asians and Native Hawaiians or other Pacific Islanders (NHPIs), in five U.S. states and Guam* — Behavioral Risk Factor Surveillance System, 2011–2014

	Total		Overall distribution		Prevalence of diagnosed diabetes	
	Asian	NHPI	Asian	NHPI	Asian	NHPI
Characteristic	No.	No.	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Age group (yrs)†						
18–44	**7,135**	**2,691**	57.0 (50.8–63.0)	66.1 (60.1–71.6)	2.0 (1.5–2.6)	5.8 (3.6–9.2)§
45–64	**6,348**	**1,415**	30.3 (26.7–34.1)	24.2 (20.4–28.6)	15.6 (13.4–18.1)	25.0 (18.6–32.7)§
≥65	**4,578**	**467**	12.7 (10.0–16.1)	9.7 (7.1–13.0)	27.1 (23.2–31.4)	34.3 (21.9–49.2)
Sex¶						
Male	**8,238**	**1,886**	47.8 (46.0–49.6)	48.8 (44.4–53.3)	12.5 (10.9–14.2)	16.5 (12.1–22.2)
Female	**9,823**	**2,687**	52.2 (50.4–54.0)	51.2 (46.7–55.6)	8.5 (7.3–9.9)	16.1 (12.0–21.4)§
Education†,¶						
Less than high school	**751**	**623**	5.1 (4.3–6.2)	12.5 (9.8–16.0)	11.0 (7.3–16.1)	27.6 (19.2–37.8)§
High school	**3,867**	**2,067**	17.5 (15.8–19.3)	34.9 (30.4–39.6)	14.2 (11.4–17.5)	12.9 (8.7–18.8)
More than high school	**13,268**	**1,860**	77.4 (75.2–79.4)	52.6 (46.8–58.3)	9.5 (8.5–10.7)	15.9 (11.3–21.7)§
Body mass index†,¶						
<25.0	**9,642**	**1,113**	61.2 (59.2–63.2)	35.4 (30.8–40.4)	7.4 (6.3–8.7)	8.6 (5.1–14.3)
25.0–29.9	**5,565**	**1,445**	29.2 (27.3–31.2)	32.6 (28.7–36.9)	11.7 (9.8–14.0)	15.4 (10.7–21.7)
≥30.0	**1,915**	**1,743**	9.6 (8.7–10.6)	32.0 (28.5–35.6)	21.9 (18.1–26.2)	25.7 (19.0–33.8)
Physically active¶,**						
Yes	**13,291**	**3,077**	78.4 (76.7–80.1)	76.6 (72.3–80.3)	9.8 (8.7–11.0)	16.5 (12.5–21.4)§
No	**3,988**	**1,324**	21.6 (19.9–23.3)	23.4 (19.7–27.7)	12.7 (10.3–15.5)	15.8 (11.1–22.0)
Total	**18,061**	**4,573**	**100**	**100**	**9.4 (8.4–10.4)**	13.3 (10.6–16.5)§
Age-adjusted total¶	**18,061**	**4,573**	—	—	**10.3 (9.3–11.1)**	16.4 (13.2–20.2)§
Adjusted total††	**18,061**	**4,573**	—	—	**9.7 (8.9–11.2)**	**11.6 (9.0–14.8)**

Abbreviation: CI = confidence interval.
* California, Hawaii, New York, Utah, Washington, and Guam.
† Statistically significant difference exists in distribution of risk factors ($p<0.05$, by chi-square test of association).
§ Statistically significant difference exists in prevalence of diabetes between racial groups ($p<0.05$, by t-test).
¶ Age-adjusted to the 2000 U.S. standard population.
** Respondents were asked if they participated in any leisure-time physical activity in the past month.
†† Data adjusted simultaneously for age, sex, education, body mass index, and leisure-time physical inactivity.

sufficient data for estimating diabetes prevalence for Asians, and 45 states lacked sufficient data to estimate prevalence for NHPIs. Thus, the six jurisdictions used for the analyses comparing Asians and NHPIs are not representative of the United States. Fourth, these estimates do not reflect the prevalence of diabetes among diverse subpopulations of Asians (*2,8–10*) or NHPIs, which might account for some of the state-specific differences with variations in the resident Asian or NHPI subpopulations. Finally, this study does not differentiate between type 1 and type 2 diabetes, which might differ among races and have implications for management of the disease.

CDC and its partners support programs to prevent and control diabetes, with the goal of achieving the greatest impact in populations with the greatest disease burden or risk. To that end, CDC is leading the National Diabetes Prevention Program,¶ designed to bring to U.S. communities evidence-based lifestyle interventions for preventing type 2 diabetes among persons at high risk. In addition, the American Medical Association and CDC have developed materials to guide physicians and other health care providers on the best methods to screen and refer high-risk patients to diabetes prevention programs in their communities. Because Asians and NHPIs are growing minority populations that are at increased risk for developing type 2 diabetes, continued surveillance for diabetes and its risk factors among Asians and NHPIs is an important component in monitoring progress toward reducing their burden of diabetes. Diabetes resources in several Asian and NHPI languages are available at http://nccd.cdc.gov/DDT_DPR.

¶ Available at http://www.cdc.gov/diabetes/prevention.

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References

1. American Diabetes Association. Standard of medical care in diabetes—2014. Diabetes Care 2013; 36(Suppl 1).
2. Karter AJ, Schillinger D, Adams AS, et al. Elevated rates of diabetes in Pacific Islanders and Asian subgroups: the Diabetes Study of Northern California (DISTANCE). Diabetes Care 2013;36:574–9.
3. McNeely MJ, Boyko EJ. Type 2 diabetes prevalence in Asian Americans: results of a national health survey. Diabetes Care 2004;27:66–9.
4. Lee JW, Brancati FL, Yeh HC. Trends in the prevalence of type 2 diabetes in Asians versus whites: results from the United States National Health Interview Survey, 1997–2008. Diabetes Care 2011;34:353–7.
5. Maskarinec G, Jacobs S, Morimoto Y, Chock M, Grandinetti A, Kolonel LN. Disparity in diabetes risk across Native Hawaiians and different Asian groups: the multiethnic cohort. Asia Pac J Public Health 2015;27:375–84.
6. Graubard BI, Korn EL. Predictive margins with survey data. Biometrics 1999;55:652–9.
7. Geiss LS, Pan L, Cadwell B, Gregg EW, Benjamin SM, Engelgau MM. Changes in incidence of diabetes in US adults, 1997–2003. Am J Prev Med 2006;30:371–7.
8. Choi SE, Chow VH, Chung SJ, Wong ND. Do risk factors explain the increased prevalence of type 2 diabetes among California Asian adults? J Immigr Minor Health 2011;13:803–8.
9. Gujral UP, Pradeepa R, Weber MB, Narayan KM, Mohan V. Type 2 diabetes in South Asians: similarities and differences with white Caucasian and other populations. Ann N Y Acad Sci 2013;1281:51–63.
10. Ma RC, Chan JC. Type 2 diabetes in East Asians: similarities and differences with populations in Europe and the United States. Ann N Y Acad Sci 2013;1281:64–91.

Exposure to Elevated Carbon Monoxide Levels at an Indoor Ice Arena — Wisconsin, 2014

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On December 13, 2014, the emergency management system in Lake Delton, Wisconsin, was notified when a male hockey player aged 20 years lost consciousness after participation in an indoor hockey tournament that included approximately 50 hockey players and 100 other attendees. Elevated levels of carbon monoxide (CO) (range = 45 ppm–165 ppm) were detected by the fire department inside the arena. The emergency management system encouraged all players and attendees to seek medical evaluation for possible CO poisoning. The Wisconsin Department of Health Services (WDHS) conducted an epidemiologic investigation to determine what caused the exposure and to recommend preventive strategies. Investigators abstracted medical records from area emergency departments (EDs) for patients who sought care for CO exposure during December 13–14, 2014, conducted a follow-up survey of ED patients approximately 2 months after the event, and conducted informant interviews. Ninety-two persons sought ED evaluation for possible CO exposure, all of whom were tested for CO poisoning. Seventy-four (80%) patients had blood carboxyhemoglobin (COHb) levels consistent with CO poisoning (*1*); 32 (43%) CO poisoning cases were among hockey players. On December 15, the CO emissions from the propane-fueled ice resurfacer were demonstrated to be 4.8% of total emissions when actively resurfacing and 2.3% when idling, both above the optimal range of 0.5%–1.0% (*2*,*3*). Incomplete fuel combustion by the ice resurfacer was the most likely source of elevated CO. CO poisonings in ice arenas can be prevented through regular maintenance of ice resurfacers, installation of CO detectors, and provision of adequate ventilation.

WDHS abstracted patient information for persons who were present at the event and subsequently sought care at four area EDs. Information collected included demographics, smoking status, underlying medical conditions, participant type (player, coach, or spectator), symptoms, COHb levels, and any treatment provided. A case of CO poisoning was defined as a blood COHb level >5.0% for nonsmokers or >10.0% for smokers (*1*) in a person who attended the tournament and was subsequently evaluated at an ED during December 13–14, 2014. Data on smoking behavior from both ED records and a follow-up survey conducted in February 2015 were used to classify cases of CO poisoning on the basis of COHb levels. COHb levels were measured using one of three methods, depending on the test available at the facility: 1) COHb saturation tests from venous blood samples; 2) noninvasive pulse CO-oximetry tests, using handheld devices; and 3) exhaled CO, using breath CO monitors. When multiple methods were used, the order of preference was venous blood sample measures, CO-oximetry, and breath CO monitors (*4*), an order which reflected the accuracy of the different tests.

In February 2015, WDHS mailed a survey to ED patients whose records had been abstracted to verify smoking status and to gather additional information on symptoms and sequelae. Because incomplete fuel combustion poses a risk for nitrogen dioxide (NO_2) exposure (*5*), respondents were also asked about symptoms associated with NO_2 exposure, including cough, coughing up blood, chest pain, chest tightness, sore throat, choking, shortness of breath, and eye irritation. If the survey was not returned, a follow-up postcard was mailed. In April 2015, WDHS personnel contacted persons who had not responded to conduct a telephone interview. Persons who did not return a survey or participate in the telephone interview were considered lost to follow-up. A t-test was used to assess whether persons who reported more symptoms during their ED visit were more likely to respond to the follow-up survey than those who reported fewer symptoms. On February 26, 2015, WDHS personnel conducted unstructured interviews with the ice arena manager and the Lake Delton Fire Chief, toured the facility, and obtained records of CO measurements and emissions test data from the ice resurfacer.

Among the 92 persons who sought ED care during December 13–14, 2014, 57% were aged 16–20 years, and 70% were male. Only one person reported being a current smoker, and two were hospitalized (Table). Symptoms reported included headache (84%), nausea (66%), vomiting (26%), dizziness (19%), and shortness of breath (10%). COHb levels were determined by venous blood for 77 (84%) persons, by CO-oximetry for 10 (11%), and by exhaled CO breath monitoring for five (5%). COHb levels ranged from 0%–21.7% (mean = 9.7%; standard deviation [SD] = 4.4%). Case status was determined using both ED and survey data sources; two persons who did not report smoking during the ED visit but reported it later in the survey were reclassified as non-CO poisonings for this analysis. Overall, 74 (80%) of evaluated patients, including 32 hockey players, met the criteria for CO poisoning (*1*). Among persons with CO poisoning,

TABLE. Selected characteristics of persons reporting to emergency departments for symptoms associated with carbon monoxide exposure — Wisconsin, December 13–14, 2014, and of persons who responded to a follow-up survey administered February–April, 2015

	Persons evaluated at ED*			Survey respondents§		
		CO poisoning			CO poisoning	
	Total (N = 92)	Yes (n = 74)†	No (n = 18)	Total (N = 47)	Yes (n = 36)†	No (n = 11)
Characteristic	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Sex						
Male	**64 (70)**	56 (76)	8 (44)	**29 (76)**	23 (64)	6 (55)
Female	**28 (30)**	18 (24)	10 (56)	**18 (24)**	13 (36)	5 (46)
Age group (yrs)						
0–15	**9 (10)**	5 (7)	4 (22)	**7 (15)**	5 (14)	2 (18)
16–20	**52 (57)**	45 (61)	7 (39)	**22 (47)**	17 (47)	5 (46)
21–25	**9 (10)**	5 (7)	4 (22)	**6 (13)**	4 (11)	3 (27)
≥25	**22 (24)**	19 (26)	3 (17)	**12 (26)**	10 (28)	1 (9)
Patient disposition						
Discharged home	**90 (98)**	73 (99)	17 (94)	**47 (100)**	36 (100)	11 (100)
Hyperbaric oxygen treatment	**2 (2)**	1 (1)	1 (6)	**0 (0)**	0 (0)	0 (0)
Smoking status						
Smoker	**1 (1)**	1 (1)	0 (0)	**4 (9)**	1 (3)	3 (27)
Nonsmoker	**91 (99)**	73 (99)	18 (100)	**40 (85)**	32 (89)	8 (73)
Unknown	**0 (0)**	0 (0)	0 (0)	**3 (6)**	3 (8)	0 (0)
Symptoms¶						
Headache	**77 (84)**	62 (84)	15 (83)	**39 (83)**	30 (83)	9 (82)
Nausea	**62 (67)**	49 (66)	13 (72)	**26 (55)**	19 (53)	7 (64)
Vomiting	**22 (24)**	19 (26)	3 (17)	**7 (15)**	5 (14)	2 (18)
Dizziness	**18 (20)**	14 (19)	4 (22)	**30 (64)**	21 (58)	9 (82)
Shortness of breath	**8 (9)**	7 (10)	1 (6)	**15 (32)**	12 (33)	3 (27)
Lightheadedness	**5 (5)**	5 (7)	0 (0)	**33 (70)**	25 (69)	8 (73)
Chest tightness	**3 (3)**	2 (3)	1 (6)	**14 (30)**	8 (22)	6 (55)
Cough	**1 (1)**	1 (1)	0 (0)	**11 (23)**	5 (14)	6 (55)
Eye irritation	**1 (1)**	1 (1)	0 (0)	**5 (11)**	4 (11)	1 (9)
Sore throat	**1 (1)**	1 (1)	1 (6)	**4 (9)**	2 (6)	2 (18)
Chest pain	**2 (2)**	1 (1)	1 (6)	**4 (9)**	2 (6)	2 (18)
Choking	**0 (0)**	0 (0)	0 (0)	**4 (9)**	2 (6)	2 (18)
Coughing up blood	**0 (0)**	0 (0)	0 (0)	**0 (0)**	0 (0)	0 (0)
Persistent symptoms (≥7 weeks)						
None				**39 (83)**	30 (83)	9 (82)
≥1				**8 (17)**	6 (17)	2 (18)

Abbreviations: CO = carbon monoxide; ED = emergency department.
* Persons who visited area EDs for evaluation of symptoms associated with CO exposure during December 13–14, 2014, and were mailed a survey (n = 91).
† Patients who were confirmed to have had CO poisoning (i.e., blood carboxyhemoglobin level >5.0% for nonsmokers and >10.0% for smokers). Case status was determined using smoking status from both ED and survey data. Two persons who would have been coded as CO-poisoned by ED data alone were reclassified as noncases for the present analyses when their smoking status became known.
§ Persons who visited area EDs for evaluation of symptoms associated with CO exposure during December 13–14, 2014, and responded to mailed survey or telephone interview (N = 47).
¶ Symptoms are not mutually exclusive. Columns do not sum to 100%.

COHb levels ranged from 5.1%–21.7% (mean = 11.1%; SD = 3.6%). The 32 hockey players had higher COHb levels (mean = 13.0%; SD = 3.6%), compared with 42 spectators (mean = 9.7%; SD = 3.0%; $p<0.001$). Two patients, the hockey player who lost consciousness at the ice arena and a woman aged 25 years who was 19 weeks pregnant, received hyperbaric oxygen treatment as inpatients. The hockey player who lost consciousness had the highest measured COHb blood level (21.7%). Supplemental oxygen was administered to 91 patients. Patients were also treated with acetaminophen (n = 14), ibuprofen (n = 1), and meperidine (n = 1) for pain, and ondansetron (n = 18) and promethazine (n = 2) for nausea, vomiting, and dizziness.

Approximately 2 months after the event, surveys were mailed to 91 persons for whom contact information was available; overall, 47 (52%) responded. Persons who reported more symptoms in the ED were not more likely to respond to the survey than those who reported fewer symptoms ($t = 1.31$, $p = 0.194$). The symptoms most commonly reported among the 36 survey respondents who had CO poisoning were lightheadedness (70%), shortness of breath (33%), and chest tightness (22%). Six (17%) of these respondents reported persistent symptoms ≥7 weeks after the incident, including memory problems (n = 4) or difficulty concentrating (n = 4). Other persistent symptoms included cough (n = 1), shortness of breath (n = 1), and mood changes (n = 1). Symptoms associated with NO_2 exposure were infrequently reported. Cough was reported by five (13.8%) persons, eye irritation by four (11.1%), sore throat by two (5.6%), chest pain by two (5.6%), and choking by two (5.6%); no one reported coughing up blood.

The informant interviews revealed that CO levels of 45 ppm–165 ppm had been detected by the local fire department on the night of the event. The measurement taken near the locker room where the hockey player lost consciousness was 140 ppm. These measurements were higher than the acceptable air quality standard for CO levels at an ice arena, which is ≤20 ppm (*6*). On December 15, 2014, the CO output of the ice resurfacer used during the weekend was measured at 4.8% of total emissions when actively resurfacing (i.e., loaded) and 2.3% when idling; both of these are above the optimal range of 0.5%–1.0% (*2*,*3*). No other mechanical CO sources were identified.

Discussion

CO is a colorless, odorless, and tasteless gas that is highly toxic. When CO is inhaled, it binds to hemoglobin to produce COHb, which appropriates the space that normally carries oxygen, thereby depriving the tissues of sufficient oxygen (*7*). Exposure to CO can cause various negative health effects ranging from headache and fatigue to coma and death; lasting neurologic problems can also occur (*2*,*7*). CO exposure episodes during indoor sporting events have been associated with substantial morbidity among exposed persons (*5*,*8*,*9*), including psychological sequelae (*10*). Exposure to CO is of particular risk to pregnant women and has been reported to result in miscarriage and developmental problems for the fetus (*5*).

This CO poisoning event was the largest reported in Wisconsin and steps have been taken to prevent future exposures at ice arena events. At the arena, multiple CO detectors were installed, and maintenance was conducted on the ice resurfacer. WDHS updated outreach materials with recommendations for trade groups, hockey organizations, coaches, and parents. These materials include detailed information on topics such as proper ventilation and symptoms of CO poisoning. WDHS has also improved surveillance for CO poisonings by using real-time alerts generated from Wisconsin Poison Center data.

The findings in this report are subject to at least two limitations. First, discrepancies in smoking status were identified between ED records and surveys. ED visit data only identified one smoker, whereas four survey respondents reported they smoked on some days. Because CO poisoning case definition was dependent upon smoking status, inadequate collection of smoking data could affect case ascertainment. Only half of persons who were evaluated in EDs responded to the survey; therefore, smokers might have been incompletely ascertained, leading to incomplete identification of cases of CO poisoning. Second, the reporting of symptoms differed between medical records and survey responses, with slightly more symptoms reported in the survey. The survey is likely less reliable as it lacks confirmatory assessments (i.e., biologic measurements) available to medical personnel in the clinical setting. Moreover, considering the delay in the administration of the survey, the possibility for recall or participation bias exists.

Despite awareness of the risk for CO poisoning from ice resurfacers with high CO emissions, large-scale CO poisoning events still occur. Increased risk communication and outreach efforts might help to prevent future events. Certain states, including Connecticut, Massachusetts, Minnesota,* Pennsylvania, and Rhode Island have enacted indoor CO monitoring requirements to prevent large-scale CO poisoning events; other public health stakeholders with multiple ice rink venues might consider this approach as an avenue for primary prevention.

Summary

What is already known on this topic?

Carbon monoxide (CO) is a human health hazard, and exposure to CO is preventable. CO cannot be detected by human senses, but exposure to CO can lead to substantial morbidity and might be fatal.

What is added by this report?

The largest CO poisoning in Wisconsin's history took place in December 2014. Seventy-four exposed persons had confirmed CO poisoning, most likely caused by a high level of CO emissions from an ice resurfacer.

What are the implications for public health practice?

Large-scale CO poisonings are a public health hazard. Ice arena managers can prevent potential CO poisonings by ensuring that 1) ice resurfacers are regularly maintained or electric-powered rather than gas-powered, 2) CO detectors are installed in the arena, and 3) arena ventilation is adequate. Health departments, policy makers, and stakeholders should look to successful prevention models and implement strategies to keep similar events from occurring.

* Additional information available at http://www.health.state.mn.us/divs/eh/indoorair/arenas/icearenarule.pdf.

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References

1. Council of State and Territorial Epidemiologists. Public health reporting and national notification for carbon monoxide poisoning. Atlanta, GA: Council of State and Territorial Epidemiologists; 2015. Available at http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PS/13-EH-01.pdf.
2. Masters GM. Introduction to environmental engineering and science. 2nd ed. Upper Saddle River, NJ: Prentice Hall; 1998.
3. Pelham TW, Holt LE, Moss MA. Exposure to carbon monoxide and nitrogen dioxide in enclosed ice arenas. Occup Environ Med 2002;59:224–33.
4. Agency for Toxic Substances and Disease Registry. Toxicological profile for carbon monoxide. Atlanta, GA: US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry; 2015. Available at http://www.atsdr.cdc.gov/toxprofiles/tp201.pdf.
5. CDC. Nitrogen dioxide and carbon monoxide intoxication in an indoor ice arena—Wisconsin, 1992. MMWR Morb Mortal Wkly Rep 1992; 41:383–5.
6. Minnesota Department of Health. Summary of ice arena rules. Minneapolis, MN: Minnesota Department of Health; 2013. Available at http://www.health.state.mn.us/divs/eh/indoorair/arenas/forms/keychangestorule.pdf.
7. Sircar K, Clower J, Shin MK, Bailey C, King M, Yip F. Carbon monoxide poisoning deaths in the United States, 1999 to 2012. Am J Emerg Med 2015;33:1140–5.
8. CDC. Carbon monoxide poisoning at an indoor ice arena and bingo hall—Seattle, 1996. MMWR Morb Mortal Wkly Rep 1996;45:265–7.
9. Paulozzi LJ, Satink F, Spengler RF. A carbon monoxide mass poisoning in an ice arena in Vermont. Am J Public Health 1991;81:222.
10. Chambers CA, Hopkins RO, Weaver LK, Key C. Cognitive and affective outcomes of more severe compared to less severe carbon monoxide poisoning. Brain Inj 2008;22:387–95.

Progress Toward Poliomyelitis Eradication — Pakistan, January 2014–September 2015

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Since Nigeria reported its last case of wild poliovirus type 1 (WPV1) in July 2014, Pakistan and Afghanistan remain the only two countries where WPV transmission has never been interrupted (*1*). This report describes actions taken and progress achieved toward polio eradication in Pakistan during January 2014–September 2015 and updates previous reports (*2*,*3*). A total of 38 WPV1 cases were reported in Pakistan during January–September 2015,* compared with 243 during the same period in 2014 (an 84% decline). Among WPV1 cases reported in 2015, 32 (84%) occurred in children aged <36 months, nine (32%) of whom had never received oral poliovirus vaccine (OPV). Twenty-six (68%) of the 38 reported cases occurred in the Federally Administered Tribal Areas (FATA) and Khyber Pakhtunkhwa (KPK) Province. During January–September 2015, WPV1 was detected in 20% (64 of 325) of environmental samples collected, compared with 34% (98 of 294) of samples collected during the same period in 2014. The quality and scope of polio eradication activities improved considerably following the establishment of a national Emergency Operations Center, which coordinated polio eradication partners' activities. All activities are following a National Polio Eradication Emergency Action Plan (*4*) that includes a rigorous action plan for the polio low transmission season (January–April). The presence of WPV1 in environmental samples in areas where no polio cases are detected highlights the need to improve surveillance for acute flaccid paralysis (AFP). Focused efforts to close remaining immunity gaps by locating, tracking, and vaccinating continually missed children and improving coverage with OPV through the routine vaccination program are needed to stop WPV transmission in Pakistan.

OPV Coverage and Immunization Activities

During 2014, national routine vaccination coverage of infants with 3 doses of oral poliovirus vaccine (OPV3) was estimated by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) to be 72%,† unchanged from the 2013 estimate (*3*). Vaccination histories (from parental recall and immunization cards) for children aged 6–23 months with AFP who do not test positive for WPV are used to estimate OPV coverage in the target population. In 2014, national coverage was estimated to be 66% nationally (representing a decline of 7% from 71% in 2013), with considerable regional variation; estimated coverage was 18% in FATA, 35% in Balochistan, 58% in Sindh, 63% in KPK, and 83% in Punjab provinces.

During January 2014–October 2015, house-to-house supplementary immunization activities (SIAs)§ using mostly monovalent oral poliovirus vaccine type 1 (mOPV1) and bivalent type 1 and 3 OPV (bOPV) targeted children aged <5 years. Trivalent OPV (tOPV) (containing OPV types 1, 2, and 3) was used strategically to reduce the risk for circulating vaccine-derived poliovirus type 2 (cVDPV2) emergence. cVDPVs are vaccine viruses that have been excreted by vaccine recipients and have circulated in areas of low vaccine coverage for extended periods of time, eventually reverting to neurovirulence. To boost the population immunity to levels needed for interruption of WPV transmission, injectable inactivated poliovirus vaccine (IPV) has been used in 11 SIAs conducted at fixed immunization posts since November 2014, covering 1.7 million children in security-compromised areas of FATA, in high-risk Union Councils¶ of Karachi, and among internally displaced high-risk populations from FATA who are temporarily residing in areas surrounding FATA. One dose of IPV at age 14 weeks was progressively introduced into routine immunization services in areas of Punjab province during July 2015, and in Sindh province during September 2015. As part of the Global Polio Eradication Initiative End-Game Strategy, 1 dose of IPV is being introduced in all OPV-using countries to boost population immunity and prepare for the withdrawal of type 2 OPV (*5*).

The percentage of children with nonpolio AFP aged 6–23 months who had never received any routine or supplemental doses of OPV (zero-dose children) declined from 6.3% in 2014 to 2.1% in 2015, and the percentage who had received ≥4 OPV doses increased from 88% in 2014 to 96% in 2015. The highest percentage of zero-dose children was recorded in FATA during 2014 (46%) and in Balochistan during 2015 (12%). During June 2012–October 2014, FATA was mostly

* Cases during January–September 2015 reported as of October 23, 2015.
† Additional information available at http://apps.who.int/immunization_monitoring/globalsummary.

§ Mass campaigns conducted for a brief period (days to weeks) in which 1 dose of OPV is administered to all children aged <5 years, regardless of vaccination history. Campaigns can be conducted nationally or in sections of the country.
¶ Union Councils are administrative units below the district level.

inaccessible during SIAs because of a ban on vaccinations by militant groups in North and South Waziristan. As previously inaccessible children left North Waziristan after the launch of military operations there in June 2014, they were vaccinated at strategically placed transit-area vaccination posts. With regained access in areas of FATA, the number of children who were inaccessible for SIAs during January–September 2015 was estimated to be <35,000, decreasing from >250,000 during 2014, and the percentage of zero-dose children among nonpolio AFP cases in FATA declined from 38% in 2014 to 8% in 2015.

Efforts to improve vaccination coverage in high-risk areas in 2015 included the establishing a network of Female Community Volunteers in Karachi and North Sindh, adopting Continuous Community Protected Vaccinations,** conducting health camps that provide a range of public health services in addition to vaccinations in 12 districts where poliovirus continues to circulate (Tier 1 districts), and expanding vaccination by permanent teams placed in key transit points to vaccinate children as they enter and leave reservoir areas (permanent transit points). Approximately 2,000 health camps were conducted in the highest risk areas of FATA, Karachi, and KPK, during which >500,000 children (including 10,000 zero-dose children) received OPV.

Surveillance Activities

AFP surveillance. In 2014, the annual nonpolio AFP rate[††] per 100,000 population aged <15 years was 6.2 nationally, ranging from 1.4–13.7 among the eight provinces and regions of Pakistan. The percentage of AFP cases for which adequate stool specimens were collected was 88% (range = 80%–92%) (Table). Despite these overall high AFP surveillance performance indicators in Pakistan, field reviews of AFP surveillance conducted in 67 districts during January–August 2015 detected gaps in surveillance quality (nonpolio AFP rates and adequate stool collection rates below target)[§§] at the sub-district level.

Environmental surveillance. Environmental surveillance supplements AFP surveillance through periodic testing of sewage samples for polioviruses. During January 2014–October 2015, a total of 615 sewage samples from 37 sampling sites were tested for polioviruses. During January–September 2015, WPV1 was detected in 20% (64 of 325) of environmental samples from 37 sampling sites, compared with 34% (98 of 294) of samples collected from 30 sites during the same period in 2014. During January–March 2015, cVDPV2 was detected in samples collected in Sindh, and ambiguous VDPV (aVDPV2) (vaccine-derived polioviruses that are either isolated from persons with no known immunodeficiency or isolated from sewage with the ultimate source unknown) was detected in subsequent specimens from Sindh KPK, and Punjab through September 2015.

WPV and cVDPV Epidemiology

During 2014, 306 WPV1 cases were reported in Pakistan, compared with 93 cases in 2013; as of October 23, 2015, a

** Continuous Community Protected Vaccinations is a mechanism used to increase vaccination coverage by recruiting and training volunteers from the local community to provide house-to-house vaccinations continually throughout the year.

†† Vaccination histories of children aged 6–23 months with AFP 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.

§§ The quality of AFP surveillance 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 an nonpolio AFP detection rate of ≥2 cases per 100,000 population aged <15 years and adequate stool specimen collection from ≥80% of AFP cases (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 leaking or desiccation]).

TABLE. Acute flaccid paralysis (AFP) surveillance indicators during 2014 and reported cases of wild poliovirus type 1 (WPV1) and circulating vaccine-derived poliovirus type 2 (cVDPV2) during January 2014–September 2015,* by region and period — Pakistan

	AFP surveillance indicators (2014)			Reported WPV1 cases				Reported cVDPV2 cases		
				Period				Period		
Region	No. of AFP cases	Nonpolio AFP rate†	% with adequate specimens§	Jan–June 2014	July–Dec 2014	Jan–Sept 2015	Total	Jan–June 2014	July–Dec 2014	Jan–Sept 2015
Pakistan overall	**5,370**	**6.2**	**88**	**100**	**206**	**38**	**344**	**19**	**3**	**2**
Azad Jammu Kashmir	46	2.7	89	0	0	0	**0**	0	0	0
Gilgit-Baltistan	10	1.4	80	0	0	0	**0**	0	0	0
Islamabad	15	2.3	87	0	0	0	**0**	0	0	0
Khyber Pakhtunkhwa	1,101	9.5	80	17	51	15	**83**	2	0	1
Punjab	2,466	5.7	92	0	4	1	**5**	0	0	0
Balochistan	231	5.3	89	0	25	6	**31**	0	0	0
Sindh	1,027	5.4	90	10	20	5	**35**	0	1	0
FATA	474	13.7	81	73	106	11	**190**	17	2	1

Abbreviation: FATA = Federally Administered Tribal Areas.

* Data through September 2015, reported as of October 23, 2015.

† Per 100,000 children 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.

total of 38 WPV1 cases had been reported during January–September 2015, compared with 243 cases reported during the same period in 2014 (Table) (Figures 1 and 2). Among the 306 polio cases reported in 2014, 56% were in zero-dose children. Among the 38 WPV1 cases reported in 2015, 11 (29%) were in zero-dose children; 32 (84%) of the 2015 cases were reported in children aged <23 months.

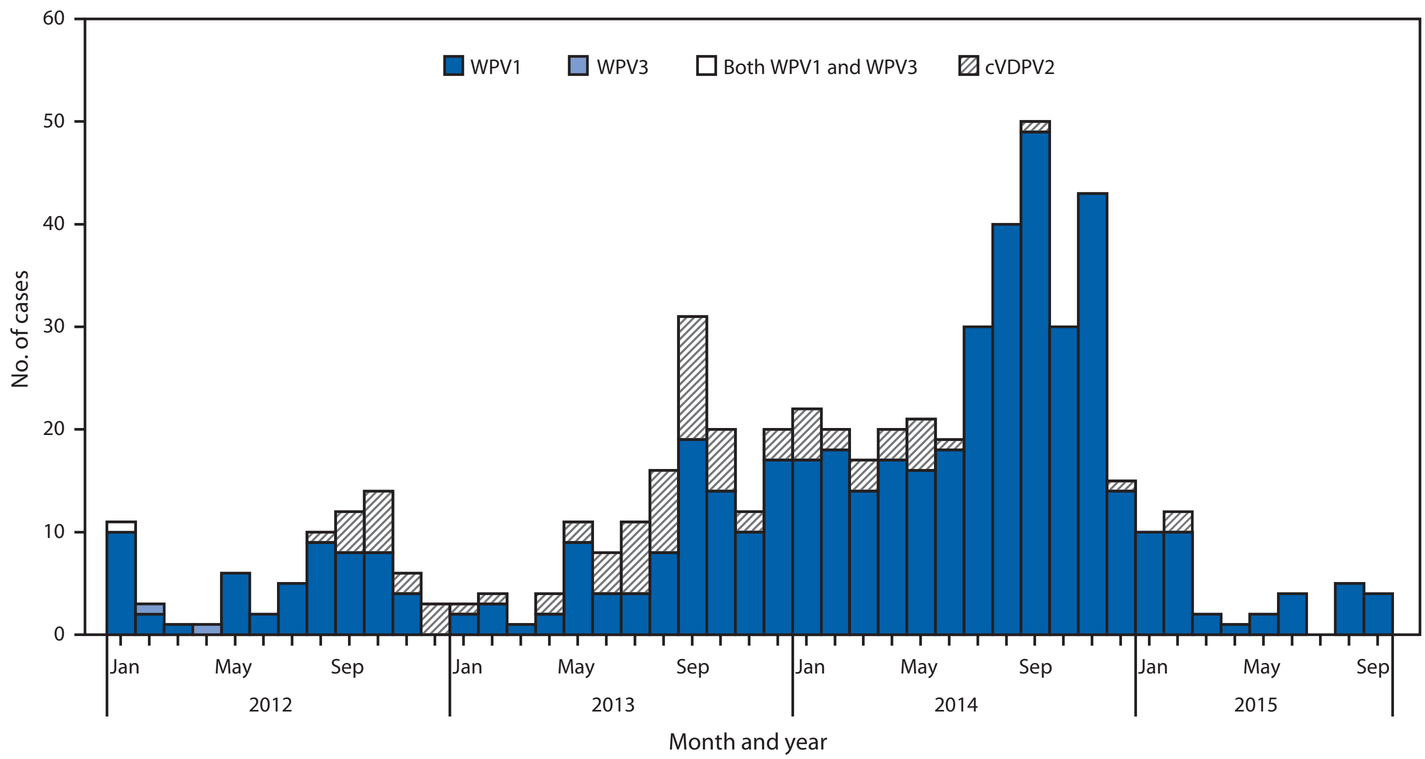
During January–September, 2015, WPV1 was detected in 17 districts, compared with 32 districts during the same period in 2014. Among the 38 WPV1 cases reported during 2015, 15 (40%) were reported from KPK, 11 (30%) from FATA, six (16%) from Balochistan, five (13%) from Sindh, and one from Punjab. The most recent case was reported from KPK, with an onset date of September 16. Although the number of cases declined compared with 2014, the percentage of orphan viruses (wild-type polioviruses that are >1.5% genetically divergent in the VP1 region from the most closely related isolate, indicating low AFP surveillance sensitivity) isolated during the first half of 2015 increased from 6% to 14%, compared with the first half of 2014. Genetic sequencing data further indicate that, in 2015, WPV1 has persisted in known sanctuaries (Quetta and Karachi) and has been shared across these sanctuaries and across the borders with Afghanistan. Reporting of cVDPV2 decreased considerably during 2014, with 22 cases reported, compared with 48 during 2013. Two cVDPV2 cases were reported during February 2015, and aVDPV2 was isolated from two persons with AFP and from environmental samples. The last WPV3 case in Pakistan was reported from FATA in 2012.

Discussion

During January–September 2015, the number of reported polio cases and WPV1 isolates detected from environmental samples sharply declined compared with the same period in 2014. This might reflect expected low incidence following the high incidence seen in 2014 (*1*), but the decline also followed the launch and rigorous implementation of a plan to intensify polio eradication activities during January–April 2015, the low transmission season. The increase in cases during 2014 compared with 2013 was caused mainly by the outbreak in North Waziristan, an area that remained inaccessible during SIAs until June 2014, as well as by the population influx from FATA into surrounding areas following military operations in North Waziristan and the subsequent appearance of cases and positive environmental samples in previously unaffected areas; however, to date in 2015, spread in these areas has been limited.

AFP and environmental surveillance data suggest that the intensity of WPV1 transmission during 2015 has been restricted to high-risk areas of KPK (Peshawar), FATA (Khyber), Sindh (Karachi), Balochistan (Quetta and Killa Abdullah), and central Pakistan (Jacobabad). However, continued detection of WPV1

FIGURE 1. Number of cases of wild poliovirus types 1 (WPV1) and 3 (WPV3) and circulating vaccine-derived poliovirus type 2 (cVDPV2), by month — Pakistan, 2012–2015

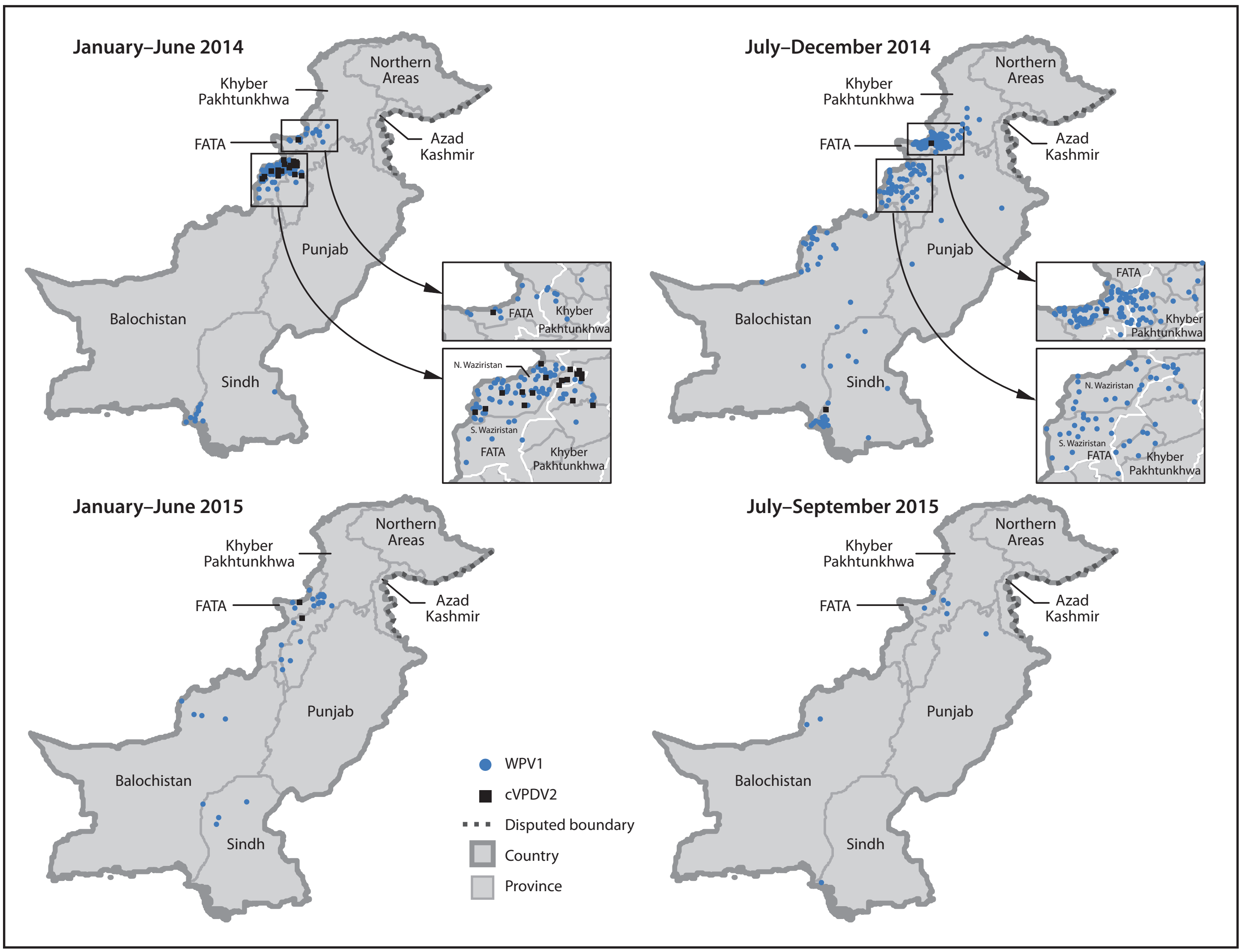


in environmental samples, reporting of a case with date of onset on September 11 in Punjab, and isolation of cVDPV from AFP cases in FATA and KPK and from environmental samples in Karachi and Quetta indicate immunity gaps and circulation of poliovirus in wide geographic areas in Pakistan.

In 2015, most areas of Pakistan have been accessible during SIAs, apart from small pockets of FATA (in parts of Khyber and North and South Waziristan); however, lack of access because of insecurity is not the main reason that children are missed during SIAs. The majority are missed because of poor-quality SIAs, related to inadequate microplanning, poor supervision and monitoring, and failure to sufficiently train and motivate field supervisors and vaccinators. As part of the low transmission season plan, vaccinators received comprehensive training, and microplans were extensively revised. A strategic shift from tracking "covered children" to tracking "continually missed children" has been implemented. Identifying children at high risk for being missed through improved microplanning and postcampaign assessments needs to continue and be expanded. In addition, because of continued WPV circulation in Afghanistan, attention needs to be focused on border crossings between Afghanistan and Pakistan.

Polio eradication efforts are led by the Prime Minister's Task Force for Polio Eradication. Government ownership and commitment, strategic coordination among partners, and systematic approaches to addressing programmatic challenges are critical factors in achieving polio eradication in Pakistan. Pakistan's Emergency Operations Center has played a vital role

FIGURE 2. Location of cases of wild poliovirus type 1 (WPV1) and circulating vaccine-derived poliovirus type 2 (cVDPV2), by period — Pakistan, January 2014–September 2015



Abbreviation: FATA = Federally Administered Tribal Areas.

Summary

What is already known on this topic?

Pakistan remains one of two countries, along with Afghanistan, where indigenous wild poliovirus (WPV) transmission has never been interrupted. Conflict and programmatic issues in both countries have resulted in pockets of missed children during immunization campaigns.

What is added by this report?

The number and geographic spread of WPV type 1 cases have decreased during January–September 2015, compared with the same period during 2013 and 2014. However, gaps in campaign performance and surveillance, evidenced by the persistence of continually missed children and the detection of wild viruses in environmental samples and orphan viruses isolated from cases and environmental samples are indicative of ongoing program challenges.

What are the implications for public health practice?

Continuing poliovirus transmission in Pakistan poses a serious challenge to the achievement of global polio eradication. To achieve the goal of ending poliovirus transmission in Pakistan in 2016, continued government leadership of the polio eradication program and further improvements in campaign quality are needed to reach and vaccinate all children.

in streamlining communications between government officials and Global Polio Eradication Initiative partners by enabling timely data sharing and decision making. Continued government leadership along with innovative methods of tracking and vaccinating missed children are key to the success of polio eradication efforts in Pakistan.

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References

1. Hagan JE, Wassilak SG, Craig AS, et al. Progress toward polio eradication—worldwide, 2014–2015. MMWR Morb Mortal Wkly Rep 2015;64:527–31.
2. Farag NH, Alexander J, Hadler S, et al. Progress toward poliomyelitis eradication—Afghanistan and Pakistan, January 2013–August 2014. MMWR Morb Mortal Wkly Rep 2014;63:973–7.
3. CDC. Progress toward poliomyelitis eradication—Pakistan, January 2012–September 2013. MMWR Morb Mortal Wkly Rep 2013;62:934–8.
4. Government of Islamic Republic of Pakistan. National emergency action plan for polio eradication 2015–2016. Islamabad, Pakistan: Government of Islamic Republic of Pakistan; 2015. Available at http://reliefweb.int/sites/reliefweb.int/files/resources/Final-pakistan-NEAP2015-16.pdf.
5. Immunization Systems Management Group of the Global Polio Eradication Initiative. Introduction of inactivated poliovirus vaccine and switch from trivalent to bivalent oral poliovirus vaccine—worldwide, 2013–2016. MMWR Morb Mortal Wkly Rep 2015;64:699–702.

Announcement

National Chronic Obstructive Pulmonary Disease Awareness Month — November 2015

Chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis, makes breathing difficult for millions of persons in the United States (*1*). November is National COPD Awareness Month, an observance supported by the National Heart, Lung, and Blood Institute's campaign, "COPD: Learn More, Breathe Better." This year's theme is "Raising Our Voices Because Millions With COPD Can't."

Persons with COPD might experience frequent coughing, excess phlegm or sputum production, shortness of breath, wheezing, or difficulty taking a deep breath. Adults with COPD are more likely to have difficulty with tasks such as walking or climbing stairs, to require the use of special equipment to manage health problems, and to be unable to work compared with persons without COPD (*2*).

Although COPD currently has no cure, it can be treated, improving symptoms and making hospitalizations less likely. The first step toward diagnosing COPD is a simple breathing test called spirometry. More information about COPD is available from CDC at http://www.cdc.gov/copd and from the National Heart, Lung, and Blood Institute at http://www.nhlbi.nih.gov/health/educational/copd.

References

1. Ford ES, Croft JB, Mannino DM, Wheaton AG, Zhang X, Giles WH. COPD surveillance—United States, 1999–2011. Chest 2013; 144:284–305.
2. Wheaton AG, Cunningham TJ, Ford ES, Croft JB. Employment and activity limitations among adults with chronic obstructive pulmonary disease—United States, 2013. MMWR Morb Mortal Wkly Rep 2015;64:289–95.

Errata

Vol. 64, No. 41

In the *MMWR* report, "Notes from the Field: *Mycobacterium chelonae* Eye Infections Associated with Humidifier Use in an Outpatient LASIK Clinic — Ohio, 2015," an error occurred on page 1177. The second sentence of the first paragraph should read, "LASIK eye surgery is typically performed in an outpatient setting and involves the use of a machine-guided laser to reshape the **cornea** of the eye to correct vision irregularities (*2*)."

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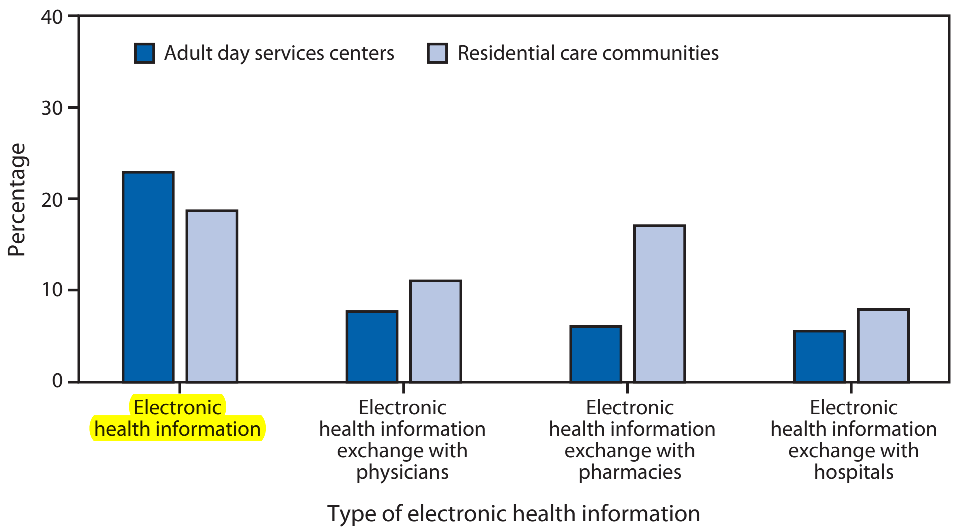
In the *MMWR* report, "Summary of Notifiable Noninfectious Conditions and Disease Outbreaks — United States," an error occurred on page 79 in Table 2, "Reported number of cases of elevated blood lead levels ≥10 μg/dL in children aged <5 years, by geographic division and area — Childhood Blood Lead Surveillance System, United States, 2007–2012." In the grouping of East South Central states, the third state listed should have been **Mississippi**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Long-Term Care Services Providers* That Use Electronic Health Records† and Have a Computerized System for Electronic Health Information Exchange,§ by Provider Sector and Type of Electronic Health Information — United States, 2014¶



* Long-term care services providers included 1) adult day services centers that were state-regulated or participated in Medicaid and self-identified as adult day care, adult day services, or adult day health services centers and 2) residential care communities that were state-regulated, had four or more beds, and provided room and board with at least two meals a day, around-the-clock onsite supervision, and help with personal care such as bathing and dressing or health-related services such as medication management. Residential care communities licensed to exclusively serve the mentally ill or the intellectually disabled/developmentally disabled populations were excluded.

† Respondents were asked, "An electronic health record is a computerized version of the resident's/participant's health and personal information used in the management of the resident's/participant's health care. Other than for accounting or billing purposes, does this residential care community/adult day services center use electronic health records?"

§ Respondents were asked, "Does this residential care community's/adult day services center's computerized system support electronic health information exchange with each of the following providers (do not include faxing)? a. physician, b. pharmacy, c. hospital."

¶ Adult day services centers and residential care communities with missing data were excluded.

In 2014, nearly one fourth (23%) of adult day services centers used electronic health records (EHRs), and fewer than 10% had a computerized system that supported electronic health information exchange with physicians (8%), pharmacies (6%), and hospitals (6%). About one fifth (19%) of residential care communities used EHRs, and 11% had a computerized system that supported electronic health information exchange with physicians, 17% with pharmacies, and 8% with hospitals.

Source: National Study of Long-Term Care Providers, 2014. Available at http://www.cdc.gov/nchs/nsltcp/nsltcp_rdc.htm.

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