Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Weekly / Vol. 64 / No. 1

January 16, 2015

National Birth Defects Prevention Month and Folic Acid Awareness Week — January 2015

Birth defects affect about one in 33 newborns in the United States (*1*). This year, National Birth Defects Prevention Month focuses on "Making Healthy Choices to Prevent Birth Defects — Make a PACT for Prevention: Plan ahead, Avoid harmful substances, Choose a healthy lifestyle, and Talk to your doctor."

Health care providers should encourage women to plan for pregnancy; avoid harmful substances, like tobacco (*2*) and alcohol (*3*); and choose a healthy lifestyle, like eating a healthy diet (*4*), to increase their chances of a healthy pregnancy. Health care providers should also discuss with women any medications they might be taking, both prescription and over-the-counter, to ensure they are taking only what is necessary. More information is available at http://www.cdc.gov/ncbddd/birthdefects/prevention.html.

January 4–10, 2015, is National Folic Acid Awareness Week. CDC urges all women of childbearing age who can become pregnant to get 400 μg of folic acid every day to help reduce the risk for neural tube defects (major birth defects of the brain and spine). Health care providers should encourage women to consume folic acid in fortified foods or supplements, or a combination of the two, in addition to a diet rich in folate. More information about folic acid is available at http://www.cdc.gov/folicacid.

References

1. CDC. Update on overall prevalence of major birth defects—Atlanta, Georgia, 1978–2005. MMWR Morb Mortal Wkly Rep 2008;57:1–5.
2. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC; 2014.
3. Sokol RJ, Delaney-Black V, Nordstrom B. Fetal alcohol spectrum disorder. JAMA 2003;290:2996–9.
4. Carmichael SL, Yang W, Feldkamp ML, et al. Reduced risks of neural tube defects and orofacial clefts with higher diet quality. Arch Pediatr Adolesc Med 2012;166:121–6.

Updated Estimates of Neural Tube Defects Prevented by Mandatory Folic Acid Fortification — United States, 1995–2011

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In 1992, the U.S. Public Health Service recommended that all women capable of becoming pregnant consume 400 μg of folic acid daily to prevent neural tube defects (NTDs) (*1*). NTDs are major birth defects of the brain and spine that occur early in pregnancy as a result of improper closure of the embryonic neural tube, which can lead to death or varying

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degrees of disability. The two most common NTDs are anencephaly and spina bifida. Beginning in 1998, the United States mandated fortification of enriched cereal grain products with 140 μg of folic acid per 100 g (*2*). Immediately after mandatory fortification, the birth prevalence of NTD cases declined. Fortification was estimated to avert approximately 1,000 NTD-affected pregnancies annually (*2*,*3*). To provide updated estimates of the birth prevalence of NTDs in the period after introduction of mandatory folic acid fortification (i.e., the post-fortification period), data from 19 population-based birth defects surveillance programs in the United States, covering the years 1999–2011, were examined. After the initial decrease, NTD birth prevalence during the post-fortification period has remained relatively stable. The number of births occurring annually without NTDs that would otherwise have been affected is approximately 1,326 (95% confidence interval = 1,122–1,531). Mandatory folic acid fortification remains an effective public health intervention. There remain opportunities for prevention among women with lower folic acid intakes, especially among Hispanic women, to further reduce the prevalence of NTDs in the United States.

In August 2014, a total of 19 population-based birth defects surveillance programs in the United States reported to CDC the number of cases of spina bifida (*International Classification of Diseases, 9th Revision, Clinical Modification* codes 741.0 and 741.9) and anencephaly (codes 740.0–740.1) among deliveries occurring during 1995–2011 among non-Hispanic whites, non-Hispanic blacks, and Hispanics, as well as all racial/ethnic groups combined. Surveillance programs were grouped by whether they systematically conducted prenatal ascertainment to capture diagnosed cases (eight sites: Arkansas, Georgia, Iowa, New York, Oklahoma, Puerto Rico, South Carolina, and Utah) or did not (11 sites: Arizona, California, Colorado, Illinois, Kentucky, Maryland, New Jersey, North Carolina, Texas, West Virginia, and Wisconsin). Programs with prenatal ascertainment monitored birth defects among live births, stillbirths, and elective terminations, and included collection of information from prenatal sources, such as prenatal diagnostic facilities.

The birth prevalences of spina bifida, anencephaly, and both NTDs combined were estimated as the total number of cases divided by the total number of live births during the pre-fortification (1995–1996) and post-fortification periods (1999–2011). These prevalence estimates were multiplied by the average number of live births in the United States for the selected periods to estimate the annual number of NTD cases nationwide. Prevalence estimates were also calculated by type of surveillance program (i.e., programs with prenatal ascertainment and programs without prenatal ascertainment) and maternal race/ethnicity (i.e., non-Hispanic white, non-Hispanic black, and Hispanic). The estimated annual number of NTDs prevented was calculated as the difference between the estimated annual number during the pre-fortification period and the estimated annual number during the post-fortification period using prevalence estimates from programs with prenatal ascertainment.

A decline in NTDs was observed for all three of the racial/ethnic groups examined between the pre-fortification and

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2015;64:[inclusive page numbers].

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post-fortification periods (Figure). The post-fortification prevalence has remained relatively stable. During the observed periods, Hispanics consistently had a higher prevalence of NTDs compared with the other racial/ethnic groups, whereas non-Hispanic blacks generally had the lowest prevalence.

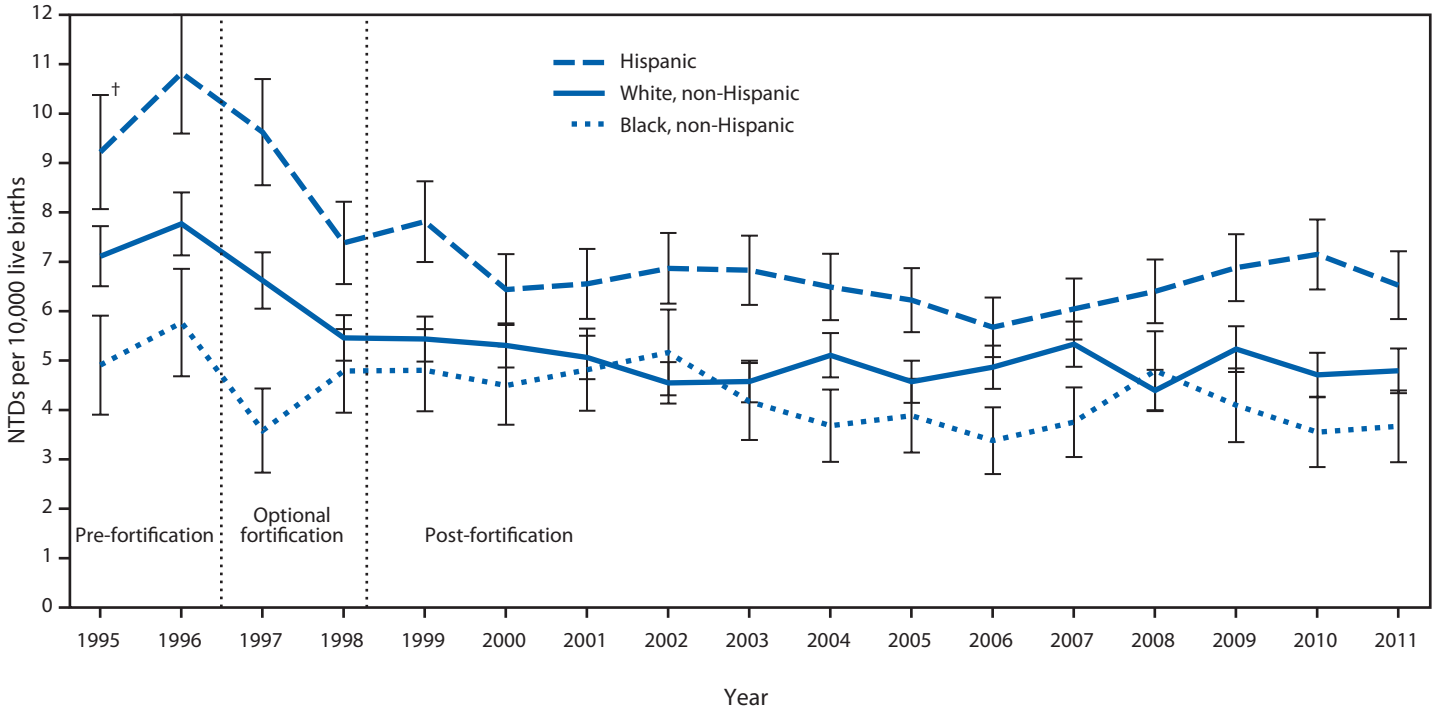
The birth prevalences of anencephaly and spina bifida during the pre-fortification (1995–1996) and post-fortification periods (biennial from 1999–2008, last 3 years of available data from 2009–2011, and all years from 1999–2011) for programs with and without prenatal ascertainment were estimated. Overall, a 28% reduction in prevalence was observed for anencephaly and spina bifida using data from all participating programs; a greater reduction (35%) was observed among programs with prenatal ascertainment than for programs without prenatal ascertainment (21%) (Table). The prevalence reported for anencephaly from programs with prenatal ascertainment was consistently higher across all racial/ethnic groups than for programs without prenatal ascertainment, whereas the difference in the observed prevalence of spina bifida was not as pronounced between the two types of programs. Based on data from programs that collect prenatal ascertainment information, an updated estimate of the number of births occurring annually without NTDs that would otherwise have been affected is 1,326 (95% confidence interval = 1,122–1,531).

Discussion

The birth prevalence of NTDs during the post-fortification period has remained relatively stable since the initial reductions observed during 1999–2000, immediately after mandatory folic acid fortification in the United States. The updated estimate of approximately 1,300 NTD-affected births averted annually during the post-fortification period is slightly higher than the previously published estimate (*3*). Factors that could have helped contribute to the difference include a gradual increase in the number of annual live births in the United States during the post-fortification period and data variations caused by differences in surveillance methodology. The lifetime direct costs for a child with spina bifida are estimated at $560,000, and for anencephaly (a uniformly fatal condition), the estimate is $5,415 (*4*); multiplying these costs by the NTD case estimates translates to an annual saving in total direct costs of approximately $508 million for the NTD-affected births that were prevented.

The reduction in NTD cases during the post-fortification period inversely mirrors the increase in serum and red blood cell (RBC) folate concentrations among women of childbearing age in the general population. Fortification led to a decrease in the prevalence of serum folate deficiency from 30% to <1%,

FIGURE. Prevalence of neural tube defects (NTDs) (anencephaly and spina bifida) before and after mandatory folic acid fortification, by maternal race/ethnicity — 19 population-based birth defects surveillance programs,* United States, 1995–2011



* Contributing programs are based in Arkansas, Arizona, California, Colorado, Georgia, Illinois, Iowa, Kentucky, Maryland, New Jersey, New York, North Carolina, Oklahoma, Puerto Rico, South Carolina, Texas, Utah, West Virginia, and Wisconsin.

† 95% confidence interval.

TABLE. Prevalence (per 10,000 live births) and estimated average annual number of spina bifida and anencephaly cases, by period and prenatal ascertainment status — 19 population-based birth defects surveillance programs, United States, 1995–1996 and 1999–2011*

Type of case / Prenatal ascertainment status	Pre-fortification	Post-fortification							Difference in estimated annual cases between pre- and post-fortification
	1995–1996	1999–2000	2001–1002	2003–2004	2005–2006	2007–2008	2009–2011	1999–2011	
Anencephaly									
Programs with prenatal ascertainment†									
Prevalence	4.2	3.3	3.2	2.7	2.9	2.9	2.8	2.9	
Estimated annual cases	1,628	1,305	1,277	1,105	1,222	1,231	1,127	1,206	422
(95% CI)	(1,440 –1,816)	(1,139–1,471)	(1,113–1441)	(950–1,260)	(1,059–1,384)	(1,067–1,394)	(1,000–1,255)	(1,142–1,269)	(298–547)
Programs without prenatal ascertainment§									
Prevalence	2.3	2.3	1.9	1.9	1.7	1.8	1.9	1.9	
Estimated annual cases	913	924	774	778	701	763	760	781	
(95% CI)	(827–1,000)	(847–1,001)	(704–845)	(708–849)	(634–768)	(693–833)	(703–817)	(754–809)	
Spina bifida									
Programs with prenatal ascertainment†									
Prevalence	6.5	4.0	4.5	3.7	4.0	4.4	3.7	4.0	
Estimated annual cases	2,549	1,617	1,792	1,517	1,678	1,869	1,476	1,645	904
(95% CI)	(2,314–2,785)	(1,433–1,802)	(1,598–1,986)	(1,336–1,698)	(1,487–1,868)	(1,668–2,070)	(1,330–1,622)	(1,571–1,719)	(743–1,066)
Programs without prenatal ascertainment§									
Prevalence	4.3	3.5	3.3	3.5	3.2	3.4	3.6	3.4	
Estimated annual cases	1,685	1,405	1,326	1,426	1,328	1,455	1,443	1,401	
(95% CI)	(1,568–1,803)	(1,310–1,501)	(1,234–1,418)	(1,330–1,521)	(1,236–1,420)	(1,359–1,551)	(1,365–1,521)	(1,364–1,438)	
Anencephaly and spina bifida									
Programs with prenatal ascertainment†									
Prevalence	10.7	7.3	7.6	6.4	6.9	7.2	6.5	7.0	
Estimated annual cases	4,177	2,922	3,069	2,622	2,899	3,100	2,604	2,851	1,326
(95% CI)	(3,876–4,479)	(2,674–3,170)	(2,815–3,323)	(2,384–2,860)	(2,649–3,150)	(2,840–3,359)	(2,410–2,797)	(2,754–2,948)	(1,122–1,531)
Programs without prenatal ascertainment§									
Prevalence	6.7	5.8	5.2	5.4	4.8	5.2	5.5	5.3	
Estimated annual cases	2,599	2,329	2,100	2,204	2,029	2,218	2,203	2,182	
(95% CI)	(2,453–2,745)	(2,206–2,452)	(1,984–2,216)	(2,085–2,322)	(1,915–2,143)	(2,100–2,337)	(2,107–2,299)	(2,136–2,228)	
Average annual live births¶	3,895,542	4,009,116	4,023,830	4,101,001	4,201,952	4,281,964	4,027,880	4,101,490	

Abbreviation: CI = confidence interval.

* Estimated annual number of cases for the specified period is calculated by multiplying the prevalence by the average number of U.S. annual live births. Data during the optional fortification period (1997–1998) are not presented.

† States with prenatal ascertainment (n = 8): Arkansas, Georgia, Iowa, New York, Oklahoma, Puerto Rico, South Carolina, and Utah.

§ States without prenatal ascertainment (n = 11): Arizona, California, Colorado, Illinois, Kentucky, Maryland, New Jersey, North Carolina, Texas, West Virginia, and Wisconsin.

¶ Data available at http://wonder.cdc.gov.

and a decrease in the prevalence of RBC folate deficiency from 6% to no measureable deficiency (*5*). A recent study modeled the dose-response relationship between RBC folate concentrations in women of childbearing age and risk for NTDs. It showed that RBC folate concentrations >1,000 nmol/L were sufficient to substantially attenuate the risk for NTDs at a population level (*6*). Using data from the National Health and Nutrition Examination Survey for 1988–2010 (*5*) and adjusting for assay differences, the estimated mean RBC folate concentration in women aged 15–44 years in the United States is 1,290–1,314 nmol/L, which appears to indicate that for many women of childbearing age, current strategies are preventing a majority of folic acid–sensitive NTDs (*5*,*6*). However, almost a quarter (21.6%) of women of childbearing age in the United States still do not have RBC folate concentrations associated with a lower risk for NTDs, and targeted strategies might be needed to achieve RBC folate concentrations >1,000 nmol/L in this group (*7*).

Although a reduction in the birth prevalence of NTDs has been observed for all three of the racial/ethnic groups examined, the prevalence among Hispanics is consistently greater than that among other racial/ethnic groups. Possible reasons could include differences in folic acid consumption and genetic factors affecting the metabolism of folic acid. Fewer Hispanic women (17%) than non-Hispanic white women (30%) report consuming ≥400 μg of folic acid per day through fortified food or supplements (*8*). A common genetic polymorphism in Hispanics, the methylenetetrahydrofolate reductase T allele, has been associated with relatively lower plasma folate and RBC folate concentrations compared with those without this polymorphism (*9*). Persons with this polymorphism have more genetic susceptibility to a folate insufficiency. To target Hispanics who might need additional folic acid intake to prevent NTDs, one strategy under consideration in the United States is to fortify corn masa flour with folic acid at the same

What is already known on this topic?

A decline in the prevalence of neural tube defects (NTDs) was reported during the period immediately after mandatory folic acid fortification in the United States, which translated to approximately 1,000 births occurring annually without anencephaly or spina bifida that would otherwise have been affected.

What is added by this report?

The prevalence of NTDs during the post-fortification period has remained relatively stable since the initial reduction observed immediately after mandatory folic acid fortification in the United States. Using the observed prevalence estimates of NTDs during 1999–2011, an updated estimate of the number of births occurring annually without NTDs that would otherwise have been affected is 1,300.

What are the implications for public health practice?

Current fortification efforts should be maintained to prevent folic acid–sensitive NTDs from occurring. There are still opportunities for prevention among women with lower folic acid intakes, especially among Hispanic women, to further reduce the prevalence of NTDs in the United States.

level as enriched cereal grain products. Implementation of corn masa flour fortification would likely prevent an additional 40 cases of NTDs annually (*10*).

The findings in this report are subject to at least one limitation. The prevalence data used in this study might not be generalizable to the entire United States, but only to the extent that NTD prevalence in other states/territories not examined could differ from NTD prevalence in the states/territories represented in this analysis.

The initial decline in NTD prevalence reported immediately after mandatory folic acid fortification has been maintained after more than a decade since implementation. Mandatory folic acid fortification remains an effective public health policy intervention.

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References

1. CDC. Recommendations for the use of folic acid to reduce the number of cases of spina bifida and other neural tube defects. MMWR Recomm Rep 1992;41(No. RR-14).
2. CDC. CDC Grand Rounds: additional opportunities to prevent neural tube defects with folic acid fortification. MMWR Morbid Mortal Wkly Rep 2010;59:980–4.
3. CDC. Spina bifida and anencephaly before and after folic acid mandate—United States, 1995–1996 and 1999–2000. MMWR Morbid Mortal Wkly Rep 2004;53:362–5.
4. Grosse SD, Ouyang L, Collins JS, Green D, Dean JH, Stevenson RE. Economic evaluation of a neural tube defect recurrence-prevention program. Am J Prev Med 2008;35:572–7.
5. Pfeiffer CM, Hughes JP, Lacher DA, et al. Estimation of trends in serum and RBC folate in the United States population from pre- to post-fortification using assay-adjusted data from the NHANES 1988–2010. J Nutr 2012;142:886–93.
6. Crider KS, Devine O, Hao L, et al. Population red blood cell folate concentrations for prevention of neural tube defects: Bayesian model. BMJ 2014;349:g4554.
7. Tinker SC, Hamner H, Crider KS. Red blood cell folate concentrations among non-pregnant United States women of childbearing age, National Health and Nutrition Examination Survey, 2007–2010. Available at http://epiresearch.org/wp-content/uploads/2014/08/abstract-book-printed.pdf.
8. Tinker SC, Cogswell ME, Devine O, Berry RJ. Folic acid intake among United States women aged 15–44 years, National Health and Nutrition Examination Survey, 2003–2006. Am J Prev Med 2010;38:534–42.
9. Crider KS, Zhu JH, Ling H, et al. MTHFR 677C→T genotype is associated with folate and homocysteine concentrations in a large population-based, double blind trial of folic acid supplementation. Am J Clin Nutr 2011;93:1365–72.
10. Tinker SC, Devine O, Mai C, et al. Estimate of the potential impact of folic acid fortification of corn masa flour on the prevention of neural tube defects. Birth Defects Res A Clin Mol Teratol 2013;97:649–57.

Supplement Use and Other Characteristics Among Pregnant Women with a Previous Pregnancy Affected by a Neural Tube Defect — United States, 1997–2009

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Neural tube defects (NTDs) include anomalies of the brain (anencephaly and encephalocele) and spine (spina bifida). Even with ongoing mandatory folic acid fortification of enriched cereal grain products, the U.S. Preventive Services Task Force recommends that women of childbearing potential consume a daily supplement containing 400 μg–800 μg of folic acid (*1*). Women with a prior NTD-affected pregnancy have an increased risk for having another NTD-affected pregnancy, and if they are planning another pregnancy, the recommendation is that they consume high-dosage folic acid supplements (4.0 mg/day) beginning ≥4 weeks before conception and continuing through the first 12 weeks of pregnancy (*2*). To learn whether folic acid supplementation (from multivitamins or single- ingredient supplements) was commonly used during pregnancy by women with a previous NTD-affected pregnancy, supplement use was assessed among a convenience sample of women with a previous NTD-affected pregnancy who participated in the National Birth Defects Prevention Study (NBDPS), a case-control study of major birth defects in the United States. Characteristics of women who previously had an NTD-affected pregnancy and whose index pregnancy (pregnancy included in NBDPS) was either affected by an NTD (N = 17) (i.e., recurrence-cases) or resulted in a live-born infant without a major birth defect (N = 10) (i.e., recurrence-controls) were assessed. Taking a supplement that included folic acid was more common among recurrence-control mothers (80%) than recurrence-case mothers (35%). The recommendation that women should take folic acid supplements just before and during early pregnancy is not being followed by many women and offers an opportunity for NTD prevention, especially among women who are at a higher risk because they have had a previous pregnancy affected by an NTD.

Before folic acid fortification in the United States, the NTD recurrence risk was estimated to be about 2%–5% (*3*). Randomized controlled trials among women with a previous NTD-affected pregnancy demonstrated that a high-dosage folic acid supplement taken periconceptionally reduces the risk for recurrence up to 100% depending on background prevalence (*2*). Because a high dosage of folic acid (4.0 mg per day) recommended for women with a previous NTD-affected pregnancy exceeds the content of typical prenatal or other multivitamins (typically 400 μg–800 μg of folic acid), women at high risk might be prescribed dietary supplements with folic acid dosages >1.0 mg (*4*).

NBDPS is a multicenter case-control study conducted to assess risk factors for selected major birth defects. Cases were ascertained through population-based surveillance programs in 10 states (Arkansas, California, Georgia, Iowa, Massachusetts, New Jersey, New York, North Carolina, Texas, and Utah) and included live births, fetal deaths (in all sites except New Jersey), and pregnancy terminations (in all sites except Massachusetts and New Jersey) affected by at least one of the included major birth defects; cases with recognized syndromes or single-gene disorders were excluded. NBDPS includes only one eligible pregnancy per mother. Controls were live births with no major birth defects selected from the same geographically defined regions, identified through hospital logs or birth certificates. Pregnancies with an estimated date of delivery from October 1, 1997, through December 31, 2009, were included, and computer-assisted telephone interviews were conducted with women 6 weeks–24 months after their estimated date of delivery. Interview topics included pregnancy history, family history of birth defects, maternal health and medication use during pregnancy, and demographics.

The descriptive analysis was limited to mothers who reported a previous NTD-affected pregnancy during the interview. Recurrence-case mothers were those whose index pregnancy was affected by encephalocele, anencephaly, or spina bifida. Recurrence-control mothers were those who had a previous NTD-affected pregnancy, whose index pregnancy was included in NBDPS as a control. Although NBDPS is a population-based study, this sample of mothers with a previous NTD-affected pregnancy should be considered a convenience sample because the only mothers eligible to be included were those who did not participate in NBDPS with a previous NTD-affected pregnancy because the birth occurred before the study began, was outside the study area, or was not ascertained, or because the mother did not participate.

Frequencies of several maternal characteristics and pregnancy exposures among cases and controls were considered: year of estimated date of delivery, clinical characteristics of the index birth and previous NTD-affected pregnancy, maternal age,

race/ethnicity, education, pre-pregnancy body mass index, vitamin and medication use, diabetes, and pregnancy intention. NBDPS does not collect information on folic acid dosage, and therefore the only indicator of whether a mother might have taken high-dosage folic acid supplement was reported use of a single-ingredient folic acid supplement, in which case it is possible that she took the recommended amount.

A previous NTD-affected pregnancy was reported by 27 mothers (Table). Of these, 17 had index pregnancies that were also NTD-affected (recurrence-cases), and 10 had index pregnancies that resulted in a live-born infant without a major birth defect (recurrence-controls). Six recurrence-case mothers (35%) reported taking either a single-ingredient folic acid supplement or a prenatal or multivitamin in the 3 months before conception, compared with eight recurrence-control mothers (80%). Reported use of a single-ingredient folic acid supplement was more common among recurrence-control mothers, 70% (seven of 10), compared with 18% (three of 17) of recurrence-case mothers.

Over one third of recurrence-case mothers were Hispanic (six of 17), whereas only one of the 10 recurrence-control mothers was Hispanic. No Hispanic or non-Hispanic black case mothers reported using a supplement with folic acid, whereas 83% of non-Hispanic white case mothers and 88% of non-Hispanic white control mothers did.

Intending to become pregnant at the time of conception was reported by most case (10 of 17) and control (eight of 10) mothers. However, only half of case mothers intending pregnancy (five of 10) took a folic acid supplement during the preconception period. Single-ingredient folic acid supplement

TABLE. Convenience sample of women with a previous pregnancy affected by a neural tube defect (NTD) — National Birth Defects Prevention Study, 1997–2009

Case no.	Case/ Control	Previous pregnancy NTD	Index pregnancy NTD	Single-ingredient folic acid vitamin use*	Prenatal or multi-vitamin use*	Maternal race/ ethnicity†	BMI category§	Medication summary B1–P2¶	Pregnancy intent summary
1	Case	SB	SB	Yes	No	White	Overweight	Opioid (morphine B2–B1, acetaminophen/hydrocodone B1); Abx (cephalexin B1 and P2–P5)	Did not care
2	Case	AN	AN	Yes	No	White	Obese	Ace-inhibitor (lisinopril B3–P1); diabetes oral medication (NOS B1–P1, metformin B3–P1)	Wanted to be pregnant then
3	Case	SB	SB	Yes	No	Other	Normal weight		Wanted to be pregnant then
4	Case	SB	SB	No	Yes	White	Overweight	Abx (antibiotic NOS B1)	Wanted to be pregnant then
5	Case	SB	SB	No	Yes	White	Obese	Opioid (acetaminophen/ propoxyphene B3–P3)	Wanted to be pregnant then
6	Case	SB	SB	No	Yes	White	Normal weight		Wanted to be pregnant then
7	Case	SB	SB	No	No	Hispanic	Normal weight		Wanted to be pregnant then
8	Case	SB	SB	No	No	Hispanic	Obese		Got pregnant while consistently using contraception
9	Case	EN	AN	No	No	Hispanic	Overweight		Wanted to be pregnant then
10	Case	SB	SB	No	No	Hispanic	Obese		Wanted to wait until later
11	Case	AN	SB	No	No	Hispanic	Normal weight		Wanted to be pregnant then
12	Case	SB	AN	No	No	Hispanic	Obese		Wanted to wait until later
13	Case	SB	EN	No	No	Black	Overweight		Wanted to be pregnant then
14	Case	SB	SB	No	No	Black	Obese		Did not want to become pregnant at all
15	Case	SB	SB	No	No	Black	Overweight	Abx (amoxicillin/clavulanate P2)	Did not want to become pregnant at all
16	Case	AN	SB	No	No	White	Normal weight		Wanted to wait until later
17	Case	EN	EN	No	No	Other	Normal weight		Wanted to be pregnant then
18	Control	AN	CO	Yes	Yes	White	Normal weight	Abx (ciprofloxacin B1)	Wanted to be pregnant then
19	Control	SB	CO	Yes	Yes	White	Normal weight		Wanted to be pregnant then
20	Control	U	CO	Yes	Yes	White	Overweight		Wanted to wait until later
21	Control	AN	CO	Yes	Yes	White	Normal weight		Wanted to be pregnant then
22	Control	SB	CO	Yes	Yes	White	Obese	Opioid (cough syrup with codeine NOS P2)	Wanted to be pregnant then
23	Control	EN	CO	Yes	No	White	Normal weight		Wanted to be pregnant then
24	Control	AN	CO	Yes	No	White	Normal weight		Stopped using contraception to get pregnant
25	Control	SB	CO	No	Yes	Hispanic	Missing		Wanted to be pregnant then
26	Control	AN and SB	CO	No	No	White	Overweight		Got pregnant while consistently using contraception
27	Control	SB	CO	No	No	Other	Underweight	Abx (cephalexin B1–P7)	Wanted to be pregnant then

Abbreviations: BMI = body mass index; SB = spina bifida; AN = anencephaly; EN = encephalocele; U = unknown phenotype; CO = control; B3, B2, B1 = 3rd, 2nd, 1st month before pregnancy; P1, P2, and P3…P9 = 1st, 2nd, 3rd...9th month of pregnancy; Abx = antibiotic; NOS = not otherwise specified.

* B3–B1 self-reported use.

† Mothers of white, black, or other race are all non-Hispanic.

§ Units in kg/m^2 where underweight = <18.5; normal weight = 18.5–24.9; overweight = 25.0–29.9; and obese = ≥30.0.

¶ B1–P2 self-reported use.

What is already known on this topic?

Women who have had a previous pregnancy affected by a neural tube defect (NTD) are at an increased risk for having another NTD-affected pregnancy. The daily use of a high-dosage (4.0 mg) folic acid supplement from ≥4 weeks before through the first 12 weeks of pregnancy has been shown to decrease risk for having a subsequent NTD-affected pregnancy.

What is added by this report?

Among 17 mothers with an NTD-affected pregnancy enrolled in the National Birth Defects Prevention Study and a history of a previous NTD-affected pregnancy, 35% reported taking a folic acid supplement, whereas among 10 mothers of live-born infants without a birth defect who had a previous NTD-affected pregnancy (i.e., controls), 80% reported taking a folic acid supplement. Six of 17 mothers with a second NTD-affected pregnancy were Hispanic, whereas only one of 10 control (second pregnancy was not NTD-affected) mothers was Hispanic; none of the seven Hispanic mothers reported using a single-ingredient folic acid supplement.

What are the implications for public health practice?

Many women who have had an NTD-affected pregnancy and are planning a subsequent pregnancy do not take a folic acid supplement. Clinicians and local health departments need to be aware that women at higher risk for having an NTD-affected pregnancy might not be following current folic acid recommendations and need to tailor prevention messages to encourage use.

use was reported among only two of 10 case and six of eight control mothers intending pregnancy.

Over one third (six of 17) of recurrence-case mothers were obese (body mass index ≥ 30) compared with one of 10 recurrence-control mothers (10%). Two recurrence-case mothers reported use of opioid medication; one in the 2 months before pregnancy and one during the 3 months before and after the start of pregnancy. One of the three recurrence-case mothers who reported use of a single-ingredient folic acid supplement stated use of an opioid; a second mother had type 2 diabetes and reported taking metformin.

Discussion

Taking a folic acid supplement (single vitamin or as part of a multivitamin) was reported by a low percentage of NBDPS recurrence-case mothers. Although the sample was small, the results are consistent with a protective effect of folic acid against recurrent NTDs, because recurrence-control mothers more often reported preconception use of folic acid supplements than recurrence-case mothers. Preventing the recurrence of NTDs by managing maternal risk factors before conception, including folic acid intake and obesity, presents important opportunities for public health.

A racial/ethnic disparity in preconception use of a high-dosage folic acid supplement has been observed previously; a Texas-based study of 195 mothers at high risk for NTD recurrence revealed a significant difference in folic acid–containing supplement use between non-Hispanic white (64.7%) and Hispanic (16.5%) mothers, even though recall of receiving postpartum advice did not vary (*5*). However, mothers who recalled receiving advice were more likely to take supplements than those who did not (*5*). Importantly, active outreach to mothers with a previous NTD-affected pregnancy has been shown to increase folic acid supplement use among mothers in South Carolina and along the Texas-Mexico border (*6,7*).

Prepregnancy obesity has been associated with NTD risk, and obesity was more common among recurrence-case mothers than recurrence-control mothers (*8*). The data do not allow for the identification of causative factors for these recurrent NTD cases, but it is of note that two of three recurrence-case mothers who reported taking a single-ingredient folic acid supplement reported other NTD risk factors, specifically obesity, prepregnancy diabetes, and opioid medication use (*8,9*).

The findings in this report are subject to at least two limitations. First, because of small numbers and the study's design, no statistical tests were performed, and recurrence risk could not be estimated. Second, for study years 1997–2005, the family history question did not distinguish between older and younger siblings, making it theoretically possible that some cases were classified as recurrent that were actually the first NTD-affected pregnancy for that mother. However, most NTD-affected siblings are older because the interview was performed as soon as possible after the estimated date of delivery of the pregnancy, on average 9 months.

This study suggests that awareness of the importance of folic acid supplement use in preconception and early pregnancy should be increased among women with a previous NTD-affected pregnancy. Barriers to implementing NTD recurrence prevention recommendations need to be identified and overcome. Communication of the importance of this preventive action by health care providers to women of childbearing age, especially those at high risk for another NTD-affected pregnancy, should be improved. Active outreach programs have been shown to be cost-effective in preventing NTD recurrences and might be considered (*10*).

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References

1. US Preventive Services Task Force. Folic acid for the prevention of neural tube defects: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2009;150:626–31.
2. CDC. Effectiveness in disease and injury prevention use of folic acid for prevention of spina bifida and other neural tube defects—1983–1991. MMWR Morb Mortal Wkly Rep 1991;40:513–6.
3. Grosse SD, Collins JS. Folic acid supplementation and neural tube defect recurrence prevention. Birth Defects Res A Clin Mol Teratol 2007; 79:737–42.
4. Hendler SS, Rorvik DR. PDR for nutritional supplements, second edition. Montvale, NJ: Medical Economics Company, Inc.; 2008.
5. CDC. Folic acid awareness and use among women with a history of a neural tube defect pregnancy—Texas, 2000–2001. MMWR Recomm Rep 2002;51(No. RR-13):16–9.
6. Dean J, Collins J, Clary N, Stevenson R. Preventing the recurrence of neural tube defects in South Carolina. Proc Greenwood Genet Center 2007;26:40–4.
7. Felkner M, Suarez L, Hendricks K, Larsen R. Implementation and outcomes of recommended folic acid supplementation in Mexican-American women with prior neural tube defect-affected pregnancies. Prev Med 2005;40:867–71.
8. Stothard KJ, Tennant PW, Bell R, Rankin J. Maternal overweight and obesity and the risk of congenital anomalies: a systematic review and meta-analysis. JAMA 2009;301:636–50.
9. Broussard CS, Rasmussen SA, Reefhuis J, et al. Maternal treatment with opioid analgesics and risk for birth defects. Am J Obstet Gynecol 2011;204:314.e1–11.
10. Grosse SD, Ouyang L, Collins JS, Green D, Dean JH, Stevenson RE. Economic evaluation of a neural tube defect recurrence-prevention program. Am J Prev Med 2008;35:572–7.

Early Estimates of Seasonal Influenza Vaccine Effectiveness — United States, January 2015

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In the United States, annual vaccination against seasonal influenza is recommended for all persons aged ≥6 months (*1*). Each season since 2004–05, CDC has estimated the effectiveness of seasonal influenza vaccine in preventing medically attended acute respiratory illness (ARI) associated with laboratory-confirmed influenza. This season, early estimates of influenza vaccine effectiveness are possible because of widespread, early circulation of influenza viruses. By January 3, 2015, 46 states were experiencing widespread flu activity, with predominance of influenza A (H3N2) viruses (*2*). This report presents an initial estimate of seasonal influenza vaccine effectiveness at preventing laboratory-confirmed influenza virus infection associated with medically attended ARI based on data from 2,321 children and adults enrolled in the U.S. Influenza Vaccine Effectiveness Network (Flu VE) during November 10, 2014–January 2, 2015. During this period, overall vaccine effectiveness (VE) (adjusted for study site, age, sex, race/ethnicity, self-rated health, and days from illness onset to enrollment) against laboratory-confirmed influenza associated with medically attended ARI was 23% (95% confidence interval [CI] = 8%–36%). Most influenza infections were due to A (H3N2) viruses. This interim VE estimate is relatively low compared with previous seasons when circulating viruses and vaccine viruses were well-matched and likely reflects the fact that more than two-thirds of circulating A (H3N2) viruses are antigenically and genetically different (drifted) from the A (H3N2) vaccine component of 2014–15 Northern Hemisphere seasonal influenza vaccines (*2*). These early, low VE estimates underscore the need for ongoing influenza prevention and treatment measures. CDC continues to recommend influenza vaccination because the vaccine can still prevent some infections with the currently circulating A (H3N2) viruses as well as other viruses that might circulate later in the season, including influenza B viruses. Even when VE is reduced, vaccination still prevents some illness and serious influenza-related complications, including thousands of hospitalizations and deaths (*3*). Persons aged ≥6 months who have not yet been vaccinated this season should be vaccinated, including persons who might already have been ill with influenza this season.

CDC always recommends antiviral medications as an adjunct to vaccination, and their potential public health benefit is magnified in the context of reduced vaccine effectiveness. All hospitalized patients and all outpatients at high risk for serious complications from influenza should be treated as soon as possible with a neuraminidase inhibitor medication if influenza is suspected. A CDC health update from January 9, 2015, regarding treatment with antiviral medications is available at http://emergency.cdc.gov/han/han00375.asp. Physicians should not wait for confirmatory influenza laboratory testing, and the decision to use an antiviral medication should not be influenced by patient vaccination status (*4*). Clinicians should be aware that influenza activity is widespread and influenza should be considered as a possible diagnosis in all patients with acute respiratory illness.

Flu VE methods have been published previously (*5*). Patients aged ≥6 months were enrolled when seeking outpatient medical care for an ARI with cough at study sites in Michigan, Pennsylvania, Texas, Washington, and Wisconsin.* Study enrollment began once laboratory-confirmed cases of influenza were identified through local surveillance. Trained study staff members reviewed appointment schedules and chief complaints to identify patients with ARI. Patients were eligible for enrollment if they 1) were aged ≥6 months on September 1, 2014, and thus eligible for vaccination; 2) reported an ARI with cough and onset ≤7 days earlier; and 3) had not yet been treated with influenza antiviral medication (e.g., oseltamivir) during this illness. Consenting participants completed an enrollment interview. Nasal and oropharyngeal swabs were collected from each patient and placed together in a single cryovial with viral

* The U.S. Flu VE Network sites and the dates enrollment began were as follows: the University of Michigan School of Public Health (the University of Michigan School of Public Health, partnered with the University of Michigan Health System, Ann Arbor, and the Henry Ford Health System, Detroit, Michigan) (November 10, 2014); Baylor Scott and White Health, Texas A&M University Health Sciences Center College of Medicine (Temple, Texas) (November 13, 2014); Group Health Cooperative (Seattle, Washington) (December 1, 2014); the University of Pittsburgh Schools of the Health Sciences and UPMC (Pittsburgh, Pennsylvania) (November 24, 2014); and the Marshfield Clinic Research Foundation (Marshfield, Wisconsin) (December 8, 2014).

transport medium. Only nasal swabs were collected for patients aged <2 years. Specimens were tested at Flu VE laboratories using CDC's real-time reverse transcription–polymerase chain reaction (rRT-PCR) protocol for detection and identification of influenza viruses.

Participants were considered vaccinated if they received ≥1 dose of any seasonal influenza vaccine ≥14 days before illness onset, according to medical records and registries (at the Wisconsin site) or medical records and self-report (at the Michigan, Pennsylvania, Texas, and Washington sites). Vaccine effectiveness was estimated as 100% x (1 - odds ratio [ratio of odds of being vaccinated among outpatients with influenza-positive test results to the odds of being vaccinated among outpatients with influenza-negative test results]); odds ratios were estimated using logistic regression. Estimates were adjusted for study site, age, sex, race/ethnicity, self-rated health, and days from illness onset to enrollment. These early interim VE estimates for the 2014–15 season were based on patients enrolled through January 2, 2015.

Of the 2,321 children and adults with ARI enrolled at the five study sites, 950 (41%) tested positive for influenza virus by rRT-PCR; 916 (96%) of these viruses were influenza A, and 35 (4%) were influenza B (Table 1). The proportion of patients with influenza differed by study site, age, race/ethnicity, and interval from onset to enrollment (Table 1). The proportion vaccinated ranged from 46% to 66% across sites and also differed by age, sex, race/ethnicity, and self-rated health status.

The proportion vaccinated with 2014–15 seasonal influenza vaccine was 49% among patients with influenza compared with 56% among influenza-negative controls (Table 2). After adjusting for study site, age, sex, race/ethnicity, self-rated health, and days from illness onset to enrollment, VE against medically attended ARI attributable to influenza A and B virus infections was 23% (CI = 8%–36%).

Among the 916 infections with influenza A viruses, 842 (92%) viruses were subtyped; 100% of those were influenza A (H3N2) viruses (Table 1). Overall, 24 influenza A (H3N2) viruses from patients enrolled in Flu VE were characterized; eight (33%) were antigenically similar to A/Texas/50/2012, and 16 (67%) were antigenically drifted. The drifted viruses had reduced titers with antiserum produced against A/Texas/50/2012 and were similar to the A/Switzerland/9715293/2013 (H3N2) virus. The adjusted VE for all ages against medically attended ARI caused by influenza A (H3N2) virus infection was 22% (CI = 5%–35%). The adjusted, age-stratified VE point estimates were 26% for persons aged 6 months–17 years, 12% for persons aged 18–49 years, and 14% for persons aged ≥50 years (Table 2). Statistically significant VE was observed only among persons aged 6 months–17 years.

Discussion

The early onset of the 2014–15 influenza season offered an opportunity to provide an early VE estimate. Overall, the estimate suggests that the 2014–15 influenza vaccine has low effectiveness against circulating influenza A (H3N2) viruses. These early findings are consistent with laboratory data demonstrating that most influenza A (H3N2) viruses circulating in the community are antigenically and genetically different from A/Texas/50/2012, the A (H3N2) component of the 2014–15 Northern Hemisphere influenza vaccine. The predominant A (H3N2) viruses detected through surveillance during the 2014–15 season have been similar to the A/Switzerland/9715293/2013 (H3N2) virus, the H3N2 virus selected for the 2015 Southern Hemisphere influenza vaccine (*2*). CDC will continue to closely monitor vaccine effectiveness this season, and these estimates might be updated as more data become available. CDC continues to recommend influenza vaccination even when there are drifted viruses circulating because the vaccine can still prevent some infections with the circulating A (H3N2) viruses and might also prevent serious complications requiring hospitalization. Also, vaccine might protect against other influenza viruses that can circulate later. As of early November, 2014, fewer than half of U.S. residents had reported receiving influenza vaccine this season.[†] Influenza vaccination, even when effectiveness is reduced, can prevent thousands of hospitalizations (*3*).

The severity and timing of influenza activity during the 2014–15 season has so far been similar to the moderately severe 2012–13 season, the last season when influenza A (H3N2) viruses predominated. Rates of influenza-associated hospitalization so far this season are similar to rates during 2012–13, with highest hospitalization rates among persons aged ≥65 years (*2*). CDC surveillance through January 3, 2015, shows that the percentage of patient visits to doctors for influenza-like-illness (ILI) this season was almost the same as at the peak of the 2012–13 season (*2*). For the past 13 seasons, influenza seasons have ranged in duration, with an average of 13 weeks of increased ILI activity. This season, as of the week ending January 3, 2015, influenza activity has been elevated for 7 consecutive weeks, suggesting that the current influenza season might continue for several weeks. Influenza activity might continue to increase, especially in parts of the country that have seen more recent increases in activity and parts of the country that have yet to experience significant influenza activity.

[†] Influenza vaccination coverage estimates for the 2014–15 season are available at http://www.cdc.gov/flu/fluvaxview/index.htm.

These early VE estimates underscore the need for additional influenza prevention and treatment measures, especially among persons aged ≥65 years, young children, and other persons at higher risk for serious influenza associated complications.[§] Influenza antiviral medications should be used as recommended[¶] for treatment in patients, regardless of their vaccination status. Antiviral treatment can reduce the duration of illness and reduce complications associated with influenza (*4*). Antiviral treatment should be used for any patient with suspected or confirmed influenza who is hospitalized, has severe or progressive illness, or is at high risk for complications from influenza, even if the illness seems mild. Persons at high risk include young children (especially children aged <2 years), pregnant women, persons with chronic medical conditions like asthma, diabetes, or heart disease, and adults aged ≥65 years.

Ideally, antiviral treatment should be initiated within 48 hours of symptom onset, when treatment is most effective (*4*). However, antiviral treatment initiated later than 48 hours after illness onset can still be beneficial for some patients. Observational studies of hospitalized patients suggest some benefit when treatment was initiated up to 4 or 5 days after symptom onset (*4*). Also, a randomized placebo-controlled study suggested clinical benefit when oseltamivir was initiated 72 hours after illness onset among febrile children with uncomplicated influenza (*6*). Clinical judgment, on the basis of the patient's disease severity and progression, age, underlying medical conditions, likelihood of influenza, and time since onset of symptoms, is important when making antiviral treatment decisions for outpatients. The decision to initiate antiviral treatment should not be delayed pending laboratory confirmation of influenza, especially if performed by insensitive assays, such as rapid influenza diagnostic tests. Health care providers should advise patients at high risk to call promptly if they get symptoms of influenza. Also, clinicians should have a high index of suspicion for influenza while influenza activity is widespread. Alternative strategies, such as health care provider–operated telephone triage, might enable patients at high risk to discuss symptoms over the phone and facilitate early initiation of treatment.

What is already known on this topic?

Effectiveness of seasonal influenza vaccine can vary and depends in part on the match between vaccine viruses and circulating influenza viruses. However, influenza vaccination, even with low effectiveness, prevents thousands of hospitalizations.

What is added by this report?

So far this season, more than two thirds of influenza A (H3N2) viruses are different from the H3N2 component of 2014–15 influenza vaccine. Based on data from 2,321 children and adults with acute respiratory illness enrolled during November 10, 2014–January 2, 2015, at five study sites with outpatient medical facilities in the United States, the overall estimated effectiveness of the 2014–15 seasonal influenza vaccine for preventing medically attended, laboratory-confirmed influenza virus infection was 23%.

What are the implications for public health practice?

Early estimates indicate that influenza vaccines provide limited protection against influenza viruses circulating so far during 2014–15 season, which were mainly influenza A (H3N2) viruses. Although vaccination should continue as long as influenza viruses are circulating, treatment with influenza antiviral medications is more important than usual. All hospitalized patients and all outpatients at high risk for serious complications should be treated as soon as possible with one of three available influenza antiviral medications if influenza is suspected.

Although antigenic match influences vaccine effectiveness, randomized studies of influenza vaccines have reported variable vaccine efficacy during seasons when antigenically drifted viruses predominated (*7*). Since October 1, 2014, drifted influenza A (H3N2) viruses have accounted for an increasing proportion of antigenically characterized A (H3N2) isolates relative to A/Texas/20/2012-like viruses (*8*). Drifted A (H3N2) viruses were first identified in a small proportion of surveillance specimens in late March 2014, after the World Health Organizations had selected the strains for inclusion in the 2014–15 Northern Hemisphere vaccine. These antigenically drifted viruses were detected with increasing frequency from July to September 2014, when they had become common among A (H3N2) viruses in the United States and abroad (*9*). As of January 3, 2015, 68% of A (H3N2) viruses isolated in the United States since October 1, 2014, were antigenically or genetically different from the A (H3N2) vaccine virus component (*2*); characterization of a limited number of A (H3N2) viruses from US Flu VE network enrollees had similar findings. Modeling conducted by CDC suggested that a VE of only 10% in older adults could prevent approximately 13,000

[§] Groups at higher risk for influenza complications include 1) children aged <5 years (especially those aged <2 years); 2) adults aged ≥65 years; 3) persons with chronic pulmonary conditions (including asthma); cardiovascular disease (except hypertension alone); renal, hepatic, or hematologic (including sickle cell) disease; metabolic disorders (including diabetes mellitus); or neurologic and neurodevelopmental conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle, such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, and spinal cord injury); 4) persons with immunosuppression, including that caused by medications or by human immunodeficiency virus infection; 5) women who are pregnant or postpartum (within 2 weeks of delivery); 6) persons aged ≤18 years who are receiving long-term aspirin therapy; 7) American Indians/Alaska Natives; 8) persons who are morbidly obese (i.e., body mass index ≥40); and 9) residents of nursing homes and other chronic care facilities.

[¶] A complete summary of guidance for antiviral use is available at http://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm.

TABLE 1. Selected characteristics of enrolled patients with medically attended acute respiratory illness, by influenza test result status and seasonal influenza vaccination status — U.S. Influenza Vaccine Effectiveness Network, United States, November 10, 2014–January 2, 2015

	Test result status					Vaccination status			
	Influenza positive		Influenza negative			Vaccinated*			
Characteristic	No.	(%)	No.	(%)	p value†	No.	Total	(%)	p value†
Overall	**950**	**(41)**	**1,371**	**(59)**		**1,236**	**2,321**	**(53)**	
Study site					**<0.001**				**<0.001**
Michigan	202	(41)	286	(59)		258	488	(53)	
Pennsylvania	239	(52)	222	(48)		210	461	(46)	
Texas	210	(41)	297	(59)		252	507	(50)	
Washington	114	(24)	361	(76)		313	475	(66)	
Wisconsin	185	(47)	205	(53)		203	390	(52)	
Sex					**0.63**				**0.01**
Male	402	(40)	594	(60)		499	996	(50)	
Female	548	(41)	777	(59)		737	1325	(56)	
Age group (yrs)					**<0.001**				**<0.001**
6 mos–8	225	(35)	413	(65)		302	638	(47)	
9–17	185	(52)	170	(48)		142	355	(40)	
18–49	268	(40)	400	(60)		307	668	(46)	
50–64	136	(38)	223	(62)		240	359	(67)	
≥65	136	(45)	165	(55)		245	301	(81)	
Race/Ethnicity§					**0.02**				**<0.001**
White	713	(41)	1021	(59)		970	1734	(56)	
Black	89	(50)	90	(50)		61	179	(34)	
Other race	78	(37)	132	(63)		107	210	(51)	
Hispanic	66	(35)	123	(65)		95	189	(50)	
Self-rated health status¶					**0.17**				**0.01**
Fair or poor	43	(38)	70	(62)		66	113	(58)	
Good	184	(37)	312	(63)		281	496	(57)	
Very good	328	(41)	474	(59)		442	802	(55)	
Excellent	388	(43)	514	(57)		443	902	(49)	
Illness onset to enrollment (days)					**<0.001**				**0.15**
<3	451	(56)	354	(44)		420	805	(52)	
3–4	330	(37)	553	(63)		458	883	(52)	
5–7	169	(27)	464	(73)		358	633	(57)	
Influenza test result									
Negative			1,371			771	1,371	(56)	
Influenza B positive**	35					17	35	(49)	
Influenza A positive**	916					448	916	(49)	
A (H1N1)pdm09	0					0	0	(0)	
A (H3N2)	842					407	842	(48)	
A subtype pending	74					41	74	(55)	

* Defined as having received ≥1 dose of vaccine ≥14 days before illness onset. A total of 92 participants who received the vaccine ≤13 days before illness onset were excluded from the study sample.

† The chi-square statistic was used to assess differences between the numbers of persons with influenza-negative and influenza-positive test results, in the distribution of enrolled patient and illness characteristics, and in differences between groups in the percentage vaccinated.

§ Enrollees were categorized into one of four mutually exclusive racial/ethnic populations: white, black, other race, and Hispanic. Persons identified as Hispanic might be of any race. Persons identified as white, black, or other race are non-Hispanic. The overall prevalences calculated included data from all racial/ethnic groups, not just the four included in this analysis. Race/ethnicity data were missing for nine enrollees.

¶ Data on self-rated health status were missing for eight enrollees.

** One patient had coinfection with influenza A (H3N2) and influenza B, making the sum 951, or one greater than the total number of influenza positives.

influenza-associated hospitalizations in adults aged ≥65 years in the United States during a moderately severe influenza season such as the 2012–13 influenza season (*3*). Vaccination is particularly important for persons at high risk for serious influenza-related complications and their close contacts.

The findings in this report are subject to at least four limitations. First, these early VE estimates are imprecise for persons aged ≥18 years, limiting ability to detect statistically significant protection against influenza illness resulting in visits to health care providers; larger numbers of enrollees are required to detect significant protection when VE is low. Second, the VE estimates in this report are limited to the prevention of outpatient medical visits, rather than more severe illness outcomes, such as hospitalization or death; studies are being conducted during the 2014–15 season to estimate VE against more severe illness outcomes. Third, vaccination status included self-report at four of five sites, and dates of vaccination and vaccine formulation were available only for persons with documented vaccination

TABLE 2. Number and percentage receiving 2014–15 seasonal influenza vaccine among 2,321 outpatients with acute respiratory illness and cough, by influenza test result status, age group, and vaccine effectiveness* against all influenza A and B and against virus type A (H3N2) — U.S. Influenza Vaccine Effectiveness Network, United States, November 10, 2014–January 2, 2015

	Influenza positive			Influenza negative			Vaccine effectiveness			
							Unadjusted		Adjusted	
Influenza type/Age group	No. vaccinated	Total sample	(%)	No. vaccinated	Total sample	(%)	(%)	(95% CI)	(%)	(95% CI)
Influenza A and B										
Overall	**465**	**950**	**(49)**	**771**	**1,371**	**(56)**	**(25)**	**(12–37)**	**(23)**	**(8–36)**
Age group (yrs)										
6 mos–17	159	410	(39)	285	583	(49)	(34)	(14–49)	(24)	(0–43)
18–49	114	268	(43)	193	400	(48)	(21)	(-8–42)	(16)	(-18–41)
≥50	192	272	(71)	293	388	(76)	(22)	(-10–45)	(23)	(-14–47)
Influenza A (H3N2)										
Overall	**407**	**841**	**(48)**	**771**	**1,371**	**(56)**	**(27)**	**(13–39)**	**(22)**	**(5–35)**
Age group (yrs)										
6 mos–17	143	375	(38)	285	583	(49)	(35)	(16–50)	(26)	(2–45)
18–49	100	235	(43)	193	400	(48)	(21)	(-10–43)	(12)	(-26–39)
≥50	164	231	(71)	293	388	(76)	(21)	(-15–45)	(14)	(-31–43)

Abbreviation: CI = confidence interval.

* Vaccine effectiveness was estimated as 100% x (1 - odds ratio [ratio of odds of being vaccinated among outpatients with influenza-positive test results to the odds of being vaccinated among outpatients with influenza-negative test results]); odds ratios were estimated using logistic regression.

obtained from medical records or immunization registries; complete vaccination data are needed to verify vaccination status and estimate VE for different vaccine formulations. Finally, future interim estimates and end-of-season VE estimates could differ from current estimates as additional patient data become available or if there is a change in circulating viruses late in the season.

Although influenza vaccines are the best tool for prevention of influenza currently available, more effective vaccines are needed. Other practices that can help decrease the spread of influenza include respiratory hygiene, cough etiquette, social distancing (e.g., staying home from work and school when ill or staying away from persons who are ill) and hand washing. Antiviral medications are an important adjunct in the treatment and control of influenza for the 2014–15 season and should be used as recommended, regardless of patient vaccination status.

Acknowledgments

Michael Susick, MPH, Jonathan Raviotta, MPH, Rhett Lieberman, MD, Heather Eng, Arlene Bullotta, Charles Rinaldo, Jr., PhD, Stephen R. Wisniewski, PhD, Joe Suyama, MD, Donald B. Middleton, MD, Evelyn Reis, MD, Leonard Urbanski, MD, University of Pittsburgh Schools of the Health Sciences and UPMC, Pittsburgh, Pennsylvania. C. Hallie Phillips, MEd, Joyce Benoit, Group Health Research Institute, Seattle, Washington. Jennifer King, MPH, Jennifer Meece, PhD, Deanna Cole, Sandra Strey, Sarah Kopitzke, MS, Carla Rottscheit, Donna David, Phil Bertz, Lynn Ivacic, Laurel Verhagen, Suellyn Murray, Deborah Hilgemann, Rebecca Pilsner, Hannatu Amaza, Alex Krenzke, Vicki Moon, Kathi Cushman, Kirsten Schultz, William Gillaspie, Kelly Mathews, Jane Wesley, Braiden Anderson, Zoe Retzlaff, Adam Smith, Bryan Joosse, Jacklyn Salzwedel, Yvonne Cerne, Krista Herkert, Keith Gilge, Kristja Vittallo, Bobbi Bradley, MPH, Marshfield Clinic Research Foundation, Marshfield, Wisconsin. Jessica Pruszynkski, PhD, Lydia Clipper, Anne Robertson, Kempapura Murthy, MPH, Sophia V. James, MS, Teresa Ponder, Deborah Furze, Hope Gonzales, Martha Zayed, Michael Reis, MD, Pedro Piedra, MD, Vasanthi Avadhanula, PhD, Baylor Scott and White Health, Temple, and Baylor College of Medicine, Houston, Texas. Suzanne E. Ohmit, DrPH, Emileigh Johnson, Rachel T. Cross, MPH, Casey Martens, EJ McSpadden, MPH, Caroline K. Cheng, MPH, Katherine Reyes, MD, Lois Lamerato, PhD, Heather Lipkovich, MPH, University of Michigan, Ann Arbor, and Henry Ford Health System, Detroit. Angela Campbell, MD, Joseph Bresee, MD, Erin Burns, MA, Jerome Tokars, MD, Daniel Jernigan, MD, Influenza Division, National Center for Immunization and Respiratory Diseases, CDC.

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References

1. Grohskopf LA, Olsen SJ, Sokolow LZ, et al. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)—United States, 2014–15 influenza season. Morb Mortal Wkly Rep 2014;63:691–7.
2. CDC. Fluview. 2014–2015 influenza season week 53 ending January 3, 2015. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. Available at http://www.cdc.gov/flu/weekly.

3. Fry AM, Kim IK, Reed C, et al. Modeling the effect of different vaccine effectiveness estimates on the number of vaccine-prevented influenza-associated hospitalizations in older adults. Clin Infect Dis 2014;59:406–9.
4. CDC. Antiviral agents for the treatment and chemoprophylaxis of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2011;60(No. RR-1).
5. McLean HQ, Thompson MG, Sundaram ME, et al. Influenza vaccine effectiveness in the United States during 2012–2013: variable protection by age and virus type. J Infect Dis 2014. Epub ahead of print.
6. Fry AM, Goswami D, Nahar K, et al. Efficacy of oseltamivir treatment started within 5 days of symptom onset to reduce influenza illness duration and virus shedding in an urban setting in Bangladesh: a randomised placebo-controlled trial. Lancet Infect Dis 2014;14:109–18.
7. Osterholm MT, Kelley NS, Sommer A, Belongia EA. Efficacy and effectiveness of influenza vaccines: a systematic review and meta-analysis. Lancet Infect Dis 2012;12:36–44.
8. Rolfes M, Blanton L, Brammer L, et al. Update: influenza activity—United States, September 28–December 6, 2014. MMWR Morb Mortal Wkly Rep 2014;63:1189–94.
9. Blanton L, Brammer L, Smith S, et al. Update: influenza activity—United States and worldwide, May 18–September 20, 2014. MMWR Morb Mortal Wkly Rep 2014;63:861–4.

Incidence of Notifiable Diseases Among American Indians/Alaska Natives — United States, 2007–2011

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American Indian/Alaska Native (AI/AN) populations experience substantial disparities in the incidence of multiple diseases compared with other racial/ethnic groups in the United States. A major goal of *Healthy People 2020* is to eliminate health disparities, monitor disease trends, and identify population groups and diseases for targeted interventions (*1*). High rates of certain infectious diseases continue to be a major problem facing AI/AN populations (*2*). During 1990–2011, incidence rates for some infectious diseases declined among AI/AN populations, but disparities remain and AI/AN populations are still disproportionately affected (*2,3*). To describe disparities in selected notifiable diseases among AI/ANs, CDC analyzed data from the National Notifiable Diseases Surveillance System (NNDSS) for 2007–2011, the most recent 5 years for which data are available. The results of this analysis of 26 infectious diseases indicate that incidence rates of 14 diseases were higher for AI/ANs than for whites. Interventions are needed to address and reduce disparities in chlamydia, gonorrhea, West Nile virus, spotted fever rickettsiosis, and other infections among AI/ANs.

NNDSS is a public health surveillance system that collects data on nationally notifiable diseases in the United States and its territories (*3*). CDC maintains the system, in collaboration with the Council of State and Territorial Epidemiologists, which determines nationally notifiable diseases and approves use of national surveillance case definitions. Each year, state epidemiologists, other Council of State and Territorial Epidemiologists members, and CDC staff members collaborate in determining for which diseases universal national case reporting yields important data and therefore should remain on the list of nationally notifiable diseases. For this study, CDC examined diseases that were notifiable during the study period and for which a minimum of 20 cases was recorded for AI/ANs. Human immunodeficiency virus/acquired immunodeficiency syndrome was excluded from the analysis because of changes in the case definition and surveillance beginning in 2009 such that data from earlier years cannot be combined with later data. Data were abstracted from a series of published annual *Summary of Notifiable Diseases* reports for sexually transmitted diseases, arboviral diseases, and tuberculosis because these diseases are not directly reported to the surveillance system. Neuroinvasive and non-neuroinvasive West Nile virus disease reports were combined in a single category as West Nile disease reports. Incidence rates for Asians/Pacific Islanders are not presented in this report because, with the exception of tuberculosis and acute viral hepatitis B, for which the rates are higher among Asians/Pacific Islanders, lower incidence rates were recorded for multiple diseases (e.g., shigellosis, salmonellosis, mumps, Lyme disease, and syphilis) compared with whites (*3*). However, Asians/Pacific Islanders and persons of "other race" category were included in the total counts for each disease. A person's race in the surveillance system is based on self-reporting, regardless of ethnicity. Incidence rates were not calculated by ethnicity (i.e., Hispanic or non-Hispanic) for this report.

For 26 notifiable diseases examined for 2007–2011, a total of 12,420,236 cases were recorded (Table). Among 20 diseases for which >10,000 cases were reported nationally, incidence was higher in nine (45%) diseases for AI/ANs. Missing data on race ranged from 0.3% for *Chlamydia trachomatis* infection and 0.8% for tuberculosis to 42% for giardiasis. Race information was complete for >70% of cases for 22 of the 26 diseases. The four with incomplete data for ≥30% of cases during this period were botulism, foodborne; ehrlichiosis, total; giardiasis; and Lyme disease. Among the 22 diseases for which >70% of records had complete race information, rates were higher in 12 (55%) among AI/ANs.

Of the 12 diseases with race information for >70% of records and for which rates were higher among AI/ANs than among whites, the largest difference was for hantavirus pulmonary syndrome, which was reported 15 times more often among AI/ANs than among whites; however, only 20 cases were reported among AI/ANs of a total of 112 cases reported during 2007–2011. The second largest difference was for tularemia, which was reported 6.8 times as often among AI/ANs. There were 47 cases among AI/ANs out of a total of 626. Among more commonly reported diseases, incidence rates were 4.2 times higher among AI/ANs than whites for spotted fever rickettsiosis, 2.5 times higher for *Chlamydia trachomatis* infections, 2.4 times higher for gonorrhea, 2.1 times higher for West Nile virus, 1.9 times higher for tuberculosis, 1.8 times higher for shigellosis, 1.6 times higher for acute hepatitis C, 1.3 times higher for invasive pneumococcal infection in children aged <5 years, 1.3 times higher for *Haemophilus influenzae* type b infection, and 1.2 times higher for invasive pneumococcal infection at all ages (Table).

TABLE. Number and incidence rate per 100,000 population for 26 selected notifiable diseases, by American Indian/Alaska Native (AI/AN), black, or white race — United States, 2007–2011

Disease	AI/ANs		Blacks		Whites		Total		Rate ratio: AI/ANs compared with whites	% with no race identified
	No.	Rate	No.	Rate	No.	Rate	No.	Rate		
Botulism, foodborne	26	0.12	28	0.03	339	0.03	672	0.04	4.38	35.42
Chickenpox (varicella)	503	2.45	7,086	8.54	7,8776	6.45	110,634	7.22	0.38	17.82
Chlamydia trachomatis	77,092	374.93	2,189,748	2,639.03	1,841,172	150.74	6,283,761	409.90	2.49	0.30
Cryptosporidiosis	223	1.08	3,202	3.86	29,010	2.38	45,721	2.98	0.46	25.63
Ehrlichiosis, total	219	1.07	167	0.20	7,250	0.59	12,348	0.81	1.79	36.46
Gonorrhea	12,764	62.08	894,198	1,077.66	317,271	25.97	4,825,097	314.75	2.39	7.31
Giardiasis	385	1.87	6,875	8.29	38,506	3.15	93,164	6.08	0.59	41.55
Haemophilus influenzae	206	1.00	1,822	2.20	9,340	0.76	14,990	0.98	1.31	20.69
Hantavirus pulmonary syndrome	20	0.10	1	0.00	77	0.01	112	0.01	15.43	10.71
Hepatitis A, viral acute	66	0.32	677	0.82	5,607	0.46	10,544	0.69	0.70	28.15
Hepatitis B, viral acute	144	0.70	3,532	4.26	9,433	0.77	184,114	12.01	0.91	2.22
Hepatitis C, viral acute	88	0.43	261	0.31	3,220	0.26	4,553	0.30	1.62	19.33
Legionellosis	42	0.20	2,890	3.48	10,590	0.87	16,870	1.10	0.24	16.87
Lyme disease	476	2.31	1,649	1.99	85,721	7.02	160,209	10.45	0.33	38.68
Meningococcal disease	48	0.23	707	0.85	2,899	0.24	4,776	0.31	0.98	18.91
Pertussis	788	3.83	3,709	4.47	57,644	4.72	85,723	5.59	0.81	23.48
Salmonellosis	1,783	8.67	21,647	26.09	142,495	11.67	252,169	16.45	0.74	28.99
Shiga toxin–producing *Escherichia coli*	161	0.78	1,020	1.23	16,749	1.37	26,058	1.70	0.57	27.09
Shigellosis	1,115	5.42	17,822	21.48	37,309	3.05	85,172	5.56	1.78	28.71
Spotted fever rickettsiosis	519	2.52	434	0.52	7,325	0.60	11,108	0.72	4.21	23.17
Streptococcus pneumoniae, invasive (all ages)	575	2.80	8,652	10.67	28,766	2.36	49,548	3.23	1.19	20.76
Streptococcus pneumoniae, invasive (age <5 years)	297	20.02	2,249	48.85	9,214	15.03	16,102	19.94	1.33	21.96
Syphilis, primary and secondary	367	1.78	31,469	37.93	28,046	2.30	66,707	4.35	0.78	4.00
Tuberculosis	813	3.95	15,167	18.28	25,944	2.12	59,458	3.88	1.86	0.77
Tularemia	47	0.23	15	0.02	413	0.03	626	0.04	6.76	21.73
West Nile virus disease	184	0.89	348	0.42	5,142	0.42	6,418	0.42	2.13	25.33
Total	**98,767**	—	**3,215,027**	—	**2,793,116**	—	**12,420,236**	—	—	—

Of the 10 diseases with race information for >70% of records for which rates were lower among AI/ANs than among whites, the largest difference was for chickenpox (varicella) which was reported 2.6 times as often among whites as among AI/ANs. The second largest difference was for cryptosporidiosis, which was reported 2.2 times as often among whites. Lyme disease was reported 3.0 times more often among whites, but 39% of records did not include race.

Discussion

The findings in this report document disparities in the reported incidence of selected notifiable infectious diseases among AI/ANs compared with whites. When compared with whites, AI/AN incidence rates were higher for 14 of 26 diseases. Race information was complete for >70% of cases for 22 of 26 (85%) diseases in this study, compared with a previous analysis (*4*) in which complete information on race was recorded for >70% of cases for only 23 of 42 diseases (55%). NNDSS has improved in coding the race variable, allowing better characterization of disease burden. It is not possible to determine if this improvement in coding is a result of several reporting jurisdictions now using the National Electronic Diseases Surveillance System (NEDSS) or a NEDSS-based compatible systems (*3*). With implementation of NEDSS or NEDSS-based systems, providers can rapidly transfer clinical and laboratory-based data electronically to health departments, thereby reducing the number and proportions of missing data elements. However, additional improvements might be possible when jurisdictions ascertain the value of efforts to increase the completeness of race information because laws and regulations that require public health reporting are under the purview of each reporting authority (*3*). The relatively low proportion of missing race data for syphilis infections and tuberculosis disease likely reflects federal and local support for more complete follow up of these cases to ensure that treatment is given and contacts are identified and treated for infection.

What is already known on this topic?

American Indian and Alaska Native (AI/AN) populations experience health disparities in infectious diseases. Although rates of infectious diseases have decreased among AI/AN populations, health disparities continue to exist for notifiable infectious diseases.

What is added by this report?

Analysis of National Notifiable Diseases Surveillance System data from 2007–2011 indicates that among 26 diseases examined, race data were included for >70% of records for 22 diseases. Among the 26, incidence rates were higher among AI/ANs than whites for 14 diseases, including chlamydia, gonorrhea, West Nile virus infection, and spotted fever rickettsiosis.

What are the implications for public health practice?

Jurisdictions with concentrated populations of AI/ANs might choose to routinely analyze their surveillance data and address concerns specific to this population. State and local health departments with large segments of AI/ANs have opportunities to develop efficient intervention efforts and programs tailored to this population.

In November 1990, the U.S. designated November as National American Indian Heritage Month. This proclamation calls for agencies and organizations to promote programs and activities that serve AI/ANs. Agencies and organizations have used NNDSS data to pursue *Healthy People 2020* objectives (*1*), to understand infectious disease trends, to assess prevention efforts, and to identify subpopulations at higher risk for multiple infections (*3*). When a surveillance system is used to monitor health status, program planners can identify areas in need of additional resources and efforts. To improve the accuracy of self-reported AI/AN status in NNDSS, jurisdictions with high proportions of AI/ANs might conduct sensitivity analyses, comparing the numbers of case reported to their surveillance systems with the numbers found in statewide hospital discharge systems (5,*6*), Indian Health Service contract health provider systems, and Indian Health Service hospital data (*5*). These types of analyses can validate the higher incidence rates recorded for hantavirus pulmonary syndrome and tularemia within this population and allow epidemiologists to identify specific risk factors.

Among potentially vaccine-preventable diseases, incidence rates were lower among AI/ANs than among whites for varicella, acute hepatitis A, acute hepatitis B, meningococcal disease, and pertussis; rates were slightly higher for *Haemophilus influenza* type b and invasive pneumococcal disease. These results suggest that, overall, the AI/AN population is receiving the full benefit of immunization programs.

The findings in this report are subject to at least four limitations. First, incidence rates are presented following the *Summary of Notifiable Diseases* format, which does not adjust the rates to control for differences in age, geography, and risk factors associated with the particular diseases (*3*). In addition, the format does not test the differences in rates for statistical significance nor explain the importance of the differences (*3*). Second, NNDSS is a passive surveillance system, and no attempt was made to confirm race categorization. Races might be misclassified on some records, and previous research has indicated that AI/ANs are disproportionately misclassified (*5*). Third, certain diseases might be underreported in NNDSS because of low priority by the state, lack of health care access of subpopulations, lack of resources for enhanced surveillance, unavailability of diagnostic tests, or many other reasons. Suboptimal reporting and completeness have been reported for several diseases of public health importance (*7*), but it is not known whether underreporting is equally distributed among racial groups. Finally, only national statistics are provided to highlight the diseases of AI/ANs. Certain states do not have high proportions of AI/ANs populations and might not have identified this group for targeting when addressing infectious diseases. Jurisdictions with concentrated populations of AI/ANs might analyze their surveillance data routinely and address concerns specific to this population.

Surveillance of notifiable diseases is essential for the prevention and control of infectious diseases. Health status assessments for AI/ANs often are hindered by a lack of complete and accurate data regarding race in surveillance systems (*5*). AI/ANs have lower socioeconomic status overall, and although those who live on reservations and tribal members have access to Indian Health Service hospital services, not all AI/ANs might have ready access to health care. State and local health departments with large segments of AI/AN populations have opportunities to develop efficient intervention efforts and programs tailored to this population (*8*).

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References

1. US Department of Health and Human Services. Healthy people 2020. Washington, DC: US Department of Health and Human Services; 2011. Available at http://www.healthpeople.gov/2020/topicsobjectives/default.aspx.
2. Holman RC, Folkema AM, Singleton RJ, et al. Disparities in infectious disease hospitalizations for American Indian/Alaska Native people. Public Health Rep 2011;126:508–21.
3. CDC. Summary of notifiable diseases—2011. MMWR Morb Mortal Wkly Rep 2013;60.

4. CDC. Racial disparities in nationally notifiable diseases—United States, 2002. MMWR Morb Mortal Wkly Rep 2005;54:9–11.
5. Jim MA, Arias E, Seneca DS, et al. Racial misclassification of American Indians and Alaska Natives by Indian Health Service contract health service delivery area. Am J Public Health 2014;104:295–302.
6. Sickbert-Bennett EE, Weber DJ, Poole C, MacDonald PDM, Maillard J. Completeness of communicable disease reporting, North Carolina, USA, 1995–1997 and 2000–2006. Emerg Infect Dis 2011;17:23–9.
7. Keramarou M, Evans MR. Completeness of infectious disease notification in the United Kingdom: a systematic review. J Infect 2012;64:555–64.
8. CDC. Chronic disease in minority populations. Atlanta, GA: US Department of Health and Human Services, CDC; 1992.

Improving Burial Practices and Cemetery Management During an Ebola Virus Disease Epidemic — Sierra Leone, 2014

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On January 13, 2015, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

As of January 3, 2015, Ebola virus disease (Ebola) has killed more than 2,500 persons in Sierra Leone since the epidemic began there in May 2014 (*1*). Ebola virus is transmitted principally by direct physical contact with an infected person or their body fluids during the later stages of illness or after death (*2*). Contact with the bodies and fluids of persons who have died of Ebola is especially common in West Africa, where family and community members often touch and wash the body of the deceased in preparation for funerals. These cultural practices have been a route of Ebola transmission (*3*). In September 2014, CDC, in collaboration with the Sierra Leone Ministry of Health and Sanitation (MOH), assessed burial practices, cemetery management, and adherence to practices recommended to reduce the risk for Ebola virus transmission. The assessment was conducted by directly observing burials and cemetery operations in three high-incidence districts. In addition, a community assessment was conducted to assess the acceptability to the population of safe, nontraditional burial practices and cemetery management intended to reduce the risk for Ebola virus transmission. This report summarizes the results of these assessments, which found that 1) there were not enough burial teams to manage the number of reported deaths, 2) Ebola surveillance, swab collection, and burial team responses to a dead body alert were not coordinated, 3) systematic procedures for testing and reporting of Ebola laboratory results for dead bodies were lacking, 4) cemetery space and management were inadequate, and 5) safe burial practices, as initially implemented, were not well accepted by communities. These findings were used to inform the development of a national standard operating procedure (SOP) for safe, dignified medical burials, released on October 1. A second, national-level, assessment was conducted during October 10–15 to assess burial team practices and training and resource needs for SOP implementation across all 14 districts in Sierra Leone. The national-level assessment confirmed that burial practices, challenges, and needs at the national level were similar to those found during the assessment conducted in the three districts. Recommendations based on the assessments included 1) district-level trainings on the components of the SOP and 2) rapid deployment across the 14 districts of additional trained burial teams supplied with adequate personal protective equipment (PPE), other equipment (e.g., chlorine, chlorine sprayers, body bags, and shovels), and vehicles. Although these assessments were conducted very early on in the response, during October–December national implementation of the SOP and recommendations might have made dignified burial safer and increased community support for these practices; an evaluation of this observation is planned.

During an Ebola epidemic, prevention and control measures include prompt and safe burial of the dead (*2*). A safe burial can be accomplished by a trained burial team using appropriate PPE, placing the body in a puncture- and leak-resistant plastic body bag, and burying the body in a grave at least 2 meters deep (*4,5*). Ideally, used burial team PPE should be incinerated or buried at a depth of at least 2 meters (*4,5*). During July and August, MOH-supported waste management and burial trainings were conducted for newly established burial teams. Burial teams that were added after these trainings were trained individually within their respective districts. The initial MOH protocol included the deployment of three different functional teams after a reported death. These teams were 1) a case investigation (Ebola surveillance) team to collect risk factor and contact information, 2) an oral swab–collection team for Ebola testing, and 3) an eight to 12-person burial team. In September, in response to growing evidence of substantial Ebola virus transmission associated with funeral attendance and contact with the bodies of Ebola victims, CDC and the MOH conducted assessments of burial practices in preparation for developing and disseminating guidance and the SOP.

Sierra Leone, in West Africa, is divided into 14 districts (Figure 1). The capital of Sierra Leone, Freetown (estimated population of 1 million), is in Western Urban District. In September 2014, five direct observational assessments were conducted in Western Urban, Western Rural, and Port Loko districts, areas with high Ebola incidence (Figure 1). Practices of burial teams, swab-collection teams, cemetery management teams, and cemeteries were directly observed and recorded. The observers conducted the direct observations without wearing PPE but remained at a safe distance of at least 3 meters away from the body at all times. In the two Western districts, the two cemeteries designated for Ebola victims were visited and assessed (King Tom for Western Urban and Waterloo for Western Rural). In Port Loko District, a cemetery designated for Ebola victims, as well as community burials

(burials conducted by burial teams using single graves dug by the community outside of an established cemetery) were evaluated. In addition, a community assessment of the acceptability of safe burial practices was conducted in Western Urban, Western Rural, and Port Loko districts. While the burial teams were removing the bodies, 15 short interviews were conducted with community counselors and family and community members that were near the homes where the person had died to learn the community and family perceptions of the cause of death, burial team procedures, and Ebola in the community.

On October 1, an SOP for safe, dignified medical burials was approved and released by the Sierra Leone National Emergency Operations Center (*4*). During October 10–15, a national-level rapid needs assessment was conducted to assess the national-level burial team practices and determine the training and resource needs for effective implementation of this SOP. In all, 12 of 14 MOH district burial team supervisors and one district medical officer were interviewed about trainings received, the process for coordinating supplies, and logistics for the daily activities of the burial teams, as well as burial team composition, practices, challenges, and needs (Table).

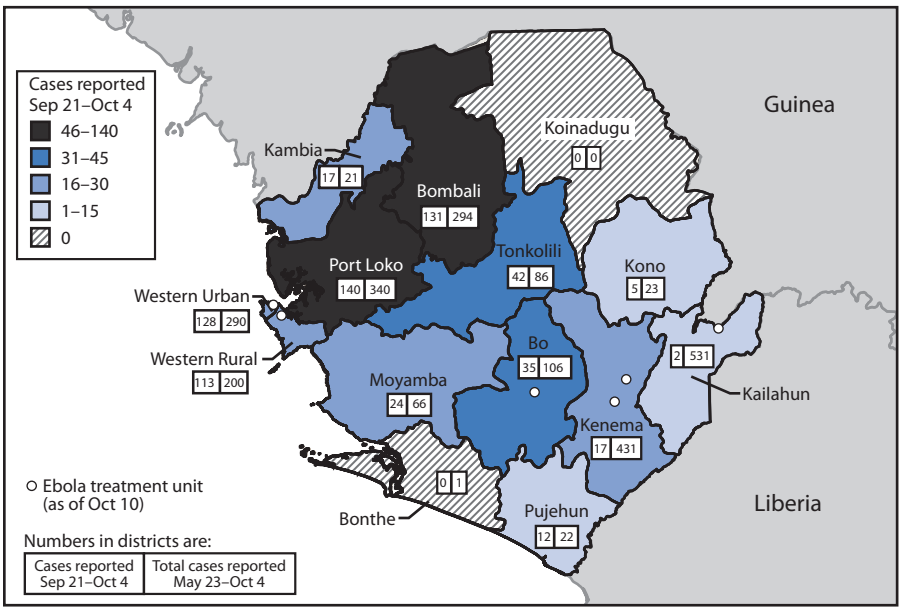
Burial Team Assessments — September and October 2014

Before October 2014, the national safe burial system in Sierra Leone required substantial human resources and was logistically complicated, resulting in delays in collecting bodies. As observed during this study, after a death, it could take 1–5 days to pick up the body. The coordination of the case investigation, swab collection, and burial teams was inconsistent, and burial teams often arrived at the location of a deceased person and buried the body before a swab specimen was collected or a case investigation was completed. When a burial team was in a community, a community counselor or leader would directly inform the team of other deceased persons requiring pick-up, which the burial team would then collect. This would bypass the official reporting structure and further complicate the coordination of investigation and swab-collection teams. Burial team size varied from six to 12 persons. Where security was a concern, a police escort sometimes accompanied the burial team.

Nationally, burial team supervisors received reports about dead bodies from many different sources and requested improved coordination and communication in their respective districts when receiving notification of a death. Notification occurred through various channels, including the district hotline or alert system, the district surveillance teams, and direct calls from community members. Whether a death was officially recorded depended on how it was reported. Deaths were not recorded if they were reported directly by community members rather than through the official alert system, leading to underreporting of deaths. For example, of the 12 bodies that were collected over a 1-day period by two Port Loko burial teams, five deaths were reported directly to the burial team supervisor by a community counselor while the burial teams were out picking up other bodies. Because these five deaths were not reported through the designated alert channels, they were not officially recorded, representing an undercount of 42% for that day for the two teams, although this is based on very small numbers.

The number of deaths to which the teams responded on a daily or weekly basis varied greatly (Table). The number of bodies that teams collected was typically higher in districts that had an Ebola treatment center or large holding facility, because the number of Ebola patients (and deaths) was higher in a facility than in the general community (Table and Figure 1). Burial teams collected as many as 10 bodies each day, which required each team member to don and doff up to 11 sets of PPE each day (the last set of PPE is donned when the burial team arrives at the cemetery) (Figure 2). This frequent change of PPE was required for safety, but could also provide occasions for breaches in infection prevention and control, specifically breaches in stringent procedures

FIGURE 1. Cumulative number of confirmed Ebola virus disease (Ebola) cases, by district — Sierra Leone, September 21–October 4, 2014



Sources: Sierra Leone Ministry of Health and Sanitation and International Federation of Red Cross and Red Crescent Societies.

TABLE. Burial team supervisors' assessments on burial team composition, practices, challenges, and needs, by district — Sierra Leone, October 1–10, 2014

District	No. of trained burial teams	No. of persons per team	No. of functional burial teams	How being alerted to a request for a body collection	Average body collection per day	Bodies collected within 24 hours	Cemetery or community burials	Swabs performed by laboratory technician	Challenges and needs
Kambia	1	8 (includes grave digger)	1	Receiving calls from community and holding center	1–2	Yes	Both	No swabs	Would like 1–2 more teams and a coordinator
Port Loko	7 (5 are emergency responder teams, district is split into 2 zones; 3 chiefdoms per team)	7 (only 2 supervisors)	7	Through hotline	15	Mostly, except when vehicle challenges occur	Cemetery for bodies collected from health facilities and community burials; district-level grave digger stays at cemetery	Just started October 1	Just received WHO vehicles but might not be sufficient for rough roads; also only 3 of the teams are being paid regularly
Bombali	2 (3rd team being trained)	11	2	Getting called directly by community and by surveillance team	10–15	80%	Cemetery 2–3 miles from Makeni and community	Swab team just started on October 2	Getting support from WHO but still need strong vehicles
Koinadugu	1 (2nd team being trained)	Team 1 = 8 (includes grave digger)	1	Called by surveillance team	2 bodies total		Community	Yes; both bodies were swabbed and negative	Getting 2 more vehicles next week, waiting for 2nd team to start after training
Tonkolili	1	8	11 (disagreement on recognition of burial teams)	Most bodies are from holding center, not community	3 (12 bodies buried in total)	Not all	Cemetery	Not coordinated	Additional teams are working and being paid, but only one has been trained by MOH and it is the only one the supervisor recognizes; need vehicles and more compensation for cemetery land owners
Kono	Cannot be reached								
Kenema	4	6 (no supervisor)	3	By holding center or surveillance team	6–7 from holding center, 4 from community; has decreased since treatment center moved	1–3 days; road access challenges cause delays	All bodies from treatment center buried in Red Cross Cemetery; other cemetery full	Yes; either laboratory technician goes with or they bring body to mortuary, but do not wait for results	Need more vehicles and sometimes the surveillance team uses their sprayers for their surveillance team visits
Kailahun	2 IFRC 4 MOH	8	2	By DMO and MSF	≥200 bodies buried to date		Cemetery	Technician just started following IFRC burial teams	Improve communication and coordination between DMO and IFRC
Bo	4	8	4	Surveillance team	4	1–3 days	Cemetery	Yes	Doing OK since WHO sent vehicles; gaining community confidence with swabs
	Training 5th team this week	Includes grave digger		Getting 4–7 calls per day				Since swabs introduced 2 weeks ago (September 22)	
Pujehun	2, as per the DMO	8; includes a grave digger			8 confirmed deaths (unknown); often do not have a body to collect in a given week				Would like more vehicles that can handle rough terrain, fuel, and refresher training

See table footnotes on next page.

TABLE. (*Continued*) Burial team supervisors' assessments on burial team composition, practices, challenges, and needs, by district — Sierra Leone, October 1–10, 2014

District	No. of trained burial teams	No. of persons per team	No. of functional burial teams	How being alerted to a request for a body collection	Average body collection per day	Bodies collected within 24 hours	Cemetery or community burials	Swabs performed by laboratory technician	Challenges and needs
Bonthe	2	8	1; only have 1 vehicle to get burial team to site, but then they do not transport body anywhere; it is carried to the community site	Do not have a hotline, community leaders call DHMT	1–2 per week; only 2 bodies collected total	Delays because of road conditions	Community	Sometimes laboratory technician shows up to body	Need vehicles appropriate for body transport and need new spraying equipment, theirs keeps breaking
Moyamba	14	8	2	Getting called directly by community and by hotline	3–4 per day	1–2 days because distance to get to bodies is far	Both	Only bodies in Moyamba town are swabbed	Would like support for at least 3 more teams, would like vehicles that can handle difficult terrain, fuel; also rainy season is now so would like rain gear
	1 trained per chiefdom	Includes grave digger	MOH only paying 2 of the teams		From community and holding center			Additional burial team members being trained to collect swabs, October 9	
Western Area	11	12	10	Hotline and called directly	30–40; approximately 20 buried in King Tom Cemetery daily	No	Cemetery	Some still waiting for results before burying body	Need more burial teams, vehicles, and improved communication and coordination

Abbreviations: WHO = World Health Organization; MOH = Ministry of Health and Sanitation, Sierra Leone; DMO = District Medical Officer; MSF = Médecins Sans Frontières; IFRC = International Federation of Red Cross and Red Crescent Societies; DHMT = District Health Management Team.

for PPE use. It also created a substantial volume of hazardous medical waste to be disposed of.

During observations, burial teams performed most infection prevention and control practices well, including using PPE and chlorine for disinfection. However, one major concern was that after body removal, decontamination of homes was limited to spraying all surfaces with 0.5% hypochlorite solution (undiluted household bleach). Bedding and other potentially contaminated materials were not removed, despite a recommendation to dispose of them (*4,5*).

During direct observation of burial teams over 3 days in the two Western districts, the homes of only two of 22 persons who had died had been visited by a case management team before the burial team arrived to remove the body. In addition, of 22 bodies collected by burial teams, a swab specimen was collected from only three. The burial team supervisor had to explain to these 19 families that they could either keep the body in a separate room and wait for a swab team to arrive and collect a specimen, then wait for the test result before learning

FIGURE 2. A burial team preparing to collect another body and transport it in the back of truck along with eight other bodies that had already been collected — Sierra Leone, September 2014

if they could bury the body, or the burial team could remove the body without a test result. By the time the burial team arrived, often more than 24 hours had elapsed since the person had died. All 19 families chose not to wait for a swab specimen to be collected but to have the body removed for safe burial.

Cemetery and Burial Practices Assessments — September and October 2014

In Western Urban District, King Tom Cemetery was the only approved location for safe burials. By October 7, a total of 420 bodies had been buried there; during September to mid-October, 30–40 bodies were buried each day. At the time of the assessment, the cemetery was not fenced and pedestrian traffic through the cemetery was high. Unmarked graves were hand-dug (Figure 3), often not to the recommended depth, and were too few to accommodate all the bodies brought to the cemetery each day. More than one body was sometimes placed into a single grave (Figure 4). Because of the challenge of appropriately disposing of large volumes of used PPE, it was placed on top of bodies, nearly filling the graves. Thus, bodies and medical waste were often not buried as deep as 2 meters, the recommended safe depth (*4,5*). Cemetery managers did not allow family members in the cemetery, and family members were not able to observe their loved ones' burial. Funerals for persons who had not been tested for Ebola were still being performed in the non-Ebola areas of the cemetery by burial agencies or mortuaries.

Safe burials in Western Rural and Port Loko districts included both cemetery and community burials. Both districts had a designated cemetery, which was an isolated open area of unfenced land where graves were dug. Families were not allowed to observe cemetery burials. Safe community burials were taking place with the approval of the chiefdom leader, which permitted the community of the person who had died to dig a grave in an area that was agreed upon by the family and the community. Then the burial team would place the body in the body bag and bury the body in the grave, usually while the community looked on.

Bodies were buried, not cremated. Districts with larger cities or towns were more likely to bury bodies in cemeteries (Table and Figure 1). Each day, burial teams collected all bodies reported to them before going to the cemetery. This often resulted in many bodies being placed together in the backs of trucks in unmarked body bags (Figure 2), which prevented individual identification and distressed the families.

Community Assessment — September 2014

Fifteen community and family interviews were conducted. An important concern among them was that family members were being buried in unmarked graves, often with multiple bodies in the same grave. These practices were considered undignified and unacceptable by the community. Safe community burials were more acceptable to community members than safe cemetery burials because families were more involved and procedures were more transparent. In addition, for 11 of 12 bodies collected by burial teams being observed in Western Urban District, the community counselors that were interviewed reported that the cause of death was unknown, and that there were no known suspected or confirmed Ebola cases in the community. During the interviews of community and family members, it was also learned that many were not aware of the risk for Ebola transmission from contact with an infectious dead body, many denied that Ebola was real, witchcraft was reported to be the cause of

FIGURE 3. Unmarked graves in an Ebola burial section of a cemetery — Sierra Leone, September 2014

FIGURE 4. Dead bodies, personal protective equipment, and medical waste buried together in unmarked graves at an unsafe depth of <2 meters — Sierra Leone, September 2014

What is already known on this topic?

Ebola virus can be transmitted through exposure to the body of an Ebola patient who has recently died, which can occur during funeral ceremonies in which mourners have direct contact with the body.

What is added by this report?

In September 2014, CDC, in collaboration with the Sierra Leone Ministry of Health and Sanitation, assessed burial practices, cemetery management, and adherence to practices recommended to reduce the risk for Ebola virus transmission in three districts with a high-incidence of Ebola virus disease (Ebola). In addition, a community assessment was conducted to assess the acceptability to the population of changes in burial practices and cemetery management intended to reduce the risk for Ebola transmission. It was found that 1) there were not enough burial teams to manage the number of reported deaths, 2) Ebola surveillance, Ebola swab collection for postmortem testing, and burial team responses to a dead body alert were not coordinated, 3) systematic procedures for testing and reporting of Ebola laboratory results for dead bodies were lacking, 4) cemetery space and management were inadequate, and 5) safe burial practices, as initially implemented, were not well accepted by communities.

What are the implications for public health practice?

Since the assessments, there have been many improvements, nationally, in safe and dignified burial practices in Sierra Leone. Fully implementing a standard operating procedure for safe, dignified medical burial nationally might decrease further transmission of Ebola virus in the country.

one death, and in one instance, an "attack" from something other than Ebola was reported as the cause.

Recommendations and Development of Standard Operating Procedures

Recommendations based on these findings from the September assessment included 1) developing multifunction burial teams that are trained to complete case investigation forms and collect swab specimens from dead bodies, and 2) conducting safe and dignified medical burials. To improve community acceptance of safe burials, increased community outreach and cemetery improvements were recommended, such as removing waste, adding fencing, and marking graves. These findings were used in developing the national SOP for safe, dignified medical burials. The SOP, with special consideration of burial practices consistent with a person's religious faith, was developed and approved by the Sierra Leone Emergency Operations Center on October 1 (*4*). The primary purpose of the SOP was to provide operational guidance for the classification of deaths, proper burial in a safe and dignified manner, and the disposal of potentially contaminated materials from the household when the body was collected. The SOP included guidance that during the epidemic, in high-incidence areas, all deceased persons should be buried by the burial teams within 24 hours, irrespective of laboratory results. Because of limited laboratory capacity, the guidance recommends swabbing only bodies of suspected and probable Ebola victims and the bodies of persons who died from an unknown cause. Deaths clearly attributable to another cause or of previously confirmed Ebola victims did not need swab testing. The policy could be further refined to address the management of dead bodies in areas with less Ebola virus transmission.

As the epidemic continues, coordination of safe burial teams is important, and district-level coordination is needed in each of Sierra Leone's 14 districts. To address the scale of the epidemic and ensure that each burial team collected a manageable number of bodies each day (judged to be five or fewer) and donned and doffed PPE a reasonable number of times per day, it was recommended that the number of burial teams in the country be increased to 120. Engagement with religious and traditional leaders to build important alliances within the community also was recommended to encourage community acceptance of safe, dignified medical burials.

Given the size of the ongoing epidemic, additional Ebola deaths are expected, and additional cemeteries for Ebola burials should be designated. In addition, as specified in the SOP, safe community burials by burial teams should be allowed, when space is available.

National Response — October–December 2014

In October, a major focus of national social mobilization efforts was the "Safe Burials Save Lives" campaign. The campaign spread the message that dead bodies needed to be handled with extreme caution and that safe burials prevent Ebola virus transmission. It promoted the SOP for safe, dignified medical burials. On October 18, 149 out of 150 Paramount Chiefs (nonpartisan members of Parliament in the government of Sierra Leone) and other traditional leaders met to discuss the need for safe burials and recognized the need to provide leadership to improve community acceptance of safe burials. Ongoing efforts to incorporate some traditions into safe burial practices continues, including the use of shrouds for Muslim families and the use of coffins for families that provide them (Figure 5). Additional safe and dignified burial practices have been implemented allowing the community and family to honor and respect the deceased; these practices include 1) allowing families to provide special clothing to the burial team to dress the deceased before they are placed inside the body bag, 2) allowing the families to come to the cemeteries to observe the burial, and allowing them to invite an imam or minister to pray with the families at a safe distance,

FIGURE 5. A burial team preparing to wrap a body in a Muslim shroud, illustrating the incorporation of a dignified component of a standard operating procedure for safe, dignified medical burial — Sierra Leone, October 2014

and 3) allowing, when possible, burial teams to conduct safe community burials close to the home of the deceased.

On October 19, with significant support from the government of the United Kingdom, a burial team command center was launched for Western Rural and Western Urban districts. This center, staffed by Republic of Sierra Leone Armed Forces troops, was responsible for coordinating the activities of all burial teams, including 1) dispatching teams, swab collection coordination, and managing cemeteries; 2) determining in real-time which burial team would respond to each reported death; and 3) ensuring that records related to each body were managed appropriately. Changes in burial team structures also were initiated to include a team of newly trained persons, with one person designated to fill out the case investigation form and another person trained to collect swab specimens. These additional persons were dispatched at the same time as the burial teams. All burial teams also were restructured to include at least one supervisor to coordinate with the identified community counselor or leader and family members, and supervise the activities of their burial team. By October 31, there were 70 trained burial teams, nationally. By the end of November, safe burial command centers were established in eight additional districts (Port Loko, Bombali, Moyamba, Kambia, Tonkolili, Kenema, Koinadugu, and Bo).

In response to the findings of inadequate Ebola cemetery management and in anticipation of future burial capacity needs in King Tom Cemetery in Freetown, major improvements of the cemetery were initiated. Improvements included removing waste, constructing a perimeter wall, marking and recording grave sites, and allowing families to visit the cemetery and observe safe burials. As of October 26, a total of 891 bodies had been buried in King Tom Cemetery.

Discussion

These preliminary assessments of burial practices in Sierra Leone found that 1) deaths were not always reported or not recorded when reported directly to the burial teams, 2) testing of bodies for Ebola was not always performed in situations where it was recommended, 3) decontamination of homes where Ebola deaths had occurred was often incomplete, and 4) not all bodies were collected by burial teams. Numerous examples of bodies being handled in an inappropriate and undignified manner were identified and included unmarked body bags being loaded into a truck, bodies being placed in unmarked graves, failure to respect or follow religious practices, and family members not being allowed to observe the burial of a loved one. By discouraging reporting and proper burial of bodies, these problems might have contributed to ongoing Ebola virus transmission in Sierra Leone. In response to these and other assessments, guidance and a safe and dignified burial SOP were developed and are being implemented across the country and have led to burying bodies in a safer, yet dignified, manner that allows many religious and cultural traditions to be honored. Ongoing efforts in Sierra Leone have addressed all of the recommendations in this report. It will be important to document these dramatic improvements.

The findings in this report are subject to at least two limitations. First, the findings of the assessment are based on relatively small sample sizes of direct observations and unstructured interviews of available family and community members. Second, the national level burial team supervisor assessment was conducted soon after the approval of the SOP and before the rapid scale-up of burial teams and command centers, which has since improved burial practices. Nonetheless, this is the first documentation of challenges faced by communities and authorities trying to make burials safe and dignified during the Ebola epidemic in Sierra Leone.

There have been challenges to changing behaviors related to safe burials, with continuing reports of unsafe and secret burials leading to new Ebola outbreaks in Sierra Leone (*6*). Continuing to improve the dignity of safe burial process by treating all bodies with respect, observing customs and religious practices to the extent that they do not endanger the living, and allowing community involvement to occur at safe distances, as called for in the SOP, might increase the acceptability of safe burials. This would likely reduce Ebola virus transmission because deaths would be more likely to be reported and bodies more likely to be buried safely by burial teams.

An important lesson from the first large-scale Ebola epidemic is the need for plans to effectively and safely handle the bodies of persons who have died from Ebola, and to execute these plans in a dignified and respectful manner that honors the deceased, their families, and their communities. Rapidly scaling up of safe, dignified burial practices and focusing on increasing community acceptance of safe burials during an Ebola epidemic could interrupt transmission substantially (*7*). Since the time of these assessments, considerable improvements have been made in burials nationally.

Acknowledgments

Sierra Leone Ministry of Health and Sanitation. CDC Sierra Leone Ebola Response Team. Department for International Development, Government of the United Kingdom. International Federation of Red Cross and Red Crescent Societies. Sierra Leone Red Cross. Republic of Sierra Leone Armed Forces. GOAL. Concern Worldwide. Médecins Sans Frontières. World Health Organization.

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References

1. Sierra Leone Ministry of Health and Sanitation. Ebola virus disease—situation report, 04 January 2015. Freetown, Sierra Leone: Sierra Leone Ministry of Health and Sanitation, 2014. Available at http://health.gov.sl/wp-content/uploads/2015/01/Ebola-Situation-Report_Vol-221.pdf.
2. Dowell SF, Mukunu R, Ksiazek TG, Khan AS, Rollin PE, Peters CJ. Transmission of Ebola hemorrhagic fever: a study of risk factors in family members, Kikwit, Democratic Republic of the Congo, 1995. J Infect Dis 1999;179:S87–91.
3. Richards P, Amara J, Ferme MC, et al. Social pathways for Ebola virus disease in rural Sierra Leone, and some implications for containment. PLoS Negl Trop Dis 2014; October 31 [Epub ahead of print]. Available at http://blogs.plos.org/speakingofmedicine/2014/10/31/social-pathways-ebola-virus-disease-rural-sierra-leone-implications-containment.
4. Sierra Leone Emergency Management Program. Standard operating procedures for safe, dignified medical burials. Freetown, Sierra Leone: Sierra Leone Emergency Management Program; 2014.
5. World Health Organization. New WHO safe and dignified burial protocol—key to reducing Ebola transmission. Geneva, Switzerland: World Health Organization; 2014. Available at http://www.who.int/mediacentre/news/notes/2014/ebola-burial-protocol/en.
6. United Nations Mission for Ebola Emergency Response. Sierra Leone: Ebola emergency weekly situation report, no. 1, 20–26 October 2014. New York, NY: United Nations Mission for Ebola Emergency Response; 2014. Available at http://reliefweb.int/sites/reliefweb.int/files/resources/Weekly_SL_SitRep1_27Oct_%20FINAL_0.pdf.
7. Meltzer MI, Atkins CY, Santibanez S, et al. Estimating the future number of cases in the Ebola epidemic—Liberia and Sierra Leone, 2014–2015. MMWR Surveill Summ 2014;63(Suppl 3).

Use of a Nationwide Call Center for Ebola Response and Monitoring During a 3-Day House-to-House Campaign — Sierra Leone, September 2014

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On January 13, 2015, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

During May 23, 2014–January 10, 2015, Sierra Leone reported 7,777 confirmed cases of Ebola virus disease (Ebola) (*1*). In response to the epidemic, on August 5, Sierra Leone's Emergency Operations Center established a toll-free, nationwide Ebola call center. The purpose of the call center is to encourage public reporting of possible Ebola cases and deaths to public health officials and to provide health education about Ebola to callers. This information also functions as an "alert" system for public health officials and supports surveillance efforts for the response. National call center dispatchers call district-level response teams composed of surveillance officers and burial teams to inform them of reported deaths and possible Ebola cases. Members of these response teams investigate cases and conduct follow-up actions such as transporting ill persons to Ebola treatment units or providing safe, dignified medical burials as resources permit. The call center continues to operate. This report describes calls received during a 3-day national campaign and reports the results of an assessment of the call center operation during the campaign.

The call center recorded all answered calls in a database. When the number of incoming calls exceeded the number of available lines, calls were not answered because there was no queue in which calls could be held for an available operator. Hence, unanswered calls were not recorded. The call center was staffed by 60 persons during two 12-hour shifts each day.

During September 19–21, the Sierra Leone government conducted a 3-day national campaign called "Ose-to-Ose Ebola Tok" (House-to-house Ebola talk), intended to provide education and galvanize support for the Ebola response. During the 3-day campaign, persons were required to stay in their homes, where they were visited by volunteer teams that provided Ebola education and sought to identify cases. More than 28,000 volunteers with knowledge of local resources and Ebola prevention information visited an estimated 75% of households nationwide during the 3-day campaign. Also, mass media and volunteers promoted using the call center to report possible cases of Ebola or to obtain more information.

An average of 1,100 calls per day was received during the 3-day campaign (Table); because of a computer malfunction on September 20, some data from that date were lost. Among the 3,299 callers during the 3-day period, 36% reported possible Ebola cases, 39% reported deaths, 9% asked for health information, 2% asked questions related to quarantine, and 23% reported other issues (e.g., questions or concerns regarding the campaign). More than one call could have reported the same death or possible case. During the campaign, 47% of reported calls came from the Western Urban and 15% came from the Western Rural district. Compared with day 1, on day 3 total call volume was 10% higher, and the number of calls reporting possible Ebola cases was 28% higher. The number of calls reporting deaths was 14% lower.

Each day during the campaign, call center dispatchers telephoned district-level response teams to notify them of reported deaths and possible cases. To determine whether calls received resulted in action by a district-level response team, the call center staff conducted a follow-up survey 1 week after the campaign. During September 26–27, the call center telephoned 191 households in Bombali, Port Loko, Western Urban, and Western Rural districts that had reported deaths (96) and possible cases (95) during September 19–21. The districts were selected by convenience and call center dispatchers recorded the number of days between the call and the response (i.e., when a burial or surveillance team visited the home).

From these four districts, among households that had reported a death, 44% reported receiving a response the same day; 37% reported a response the next day; 7% reported a response within 2–3 days of calling; and 12% reported receiving no response by a district team. Among households that reported possible cases, 31% reported receiving a response the same day; 14% reported a response the next day; 6% reported a response within 2-3 days of calling, and 50% reported there was no response from district teams.

The findings in this report are subject to at least three limitations. First, a computer malfunction resulted in incomplete data for September 20. Second, the data are not generalizable to other areas. Finally, the usefulness of call center data was limited in trying to understand why some district team responses were delayed or incomplete.

Sierra Leone's 3-day national campaign was a highly publicized effort to raise Ebola awareness and educate the public about prevention, home care, and treatment options. The call center was used to answer questions from citizens and helped the government manage the outbreak response. In the follow-up survey, a response on the same or next day was received for 81% of reported

TABLE. Number of incoming calls, reported deaths, and reported possible Ebola patients, by district — nationwide Ebola call center, Sierra Leone, September 19–21, 2014

District	September 19	September 20*	September 21	Total
No. of incoming calls				
Bombali	73	52	76	201
Port Loko	96	44	101	241
Western Rural	166	125	190	481
Western Urban	503	389	663	1,555
11 other districts†	355	188	278	821
Total	**1,193**	**798**	**1,308**	**3,299**
No. of reported deaths				
Bombali	17	6	14	37
Port Loko	14	7	31	52
Western Rural	96	76	81	253
Western Urban	220	203	250	673
11 other districts†	163	53	65	281
Total	**510**	**345**	**441**	**1,296**
No. of reported possible Ebola cases				
Bombali	34	26	39	99
Port Loko	37	21	39	97
Western Rural	37	31	63	131
Western Urban	178	126	284	588
11 other districts†	125	62	100	287
Total	**411**	**266**	**525**	**1,202**

* Data for September 20 are incomplete because of a computer malfunction resulting in data loss.

† The 11 districts were Bo, Bonthe, Bonthe Island, Kailahun, Kambia, Kenema, Koinadugu, Moyamba, Pujehun, and Tonkolili.

deaths but only 45% of possible cases. Because treatment and isolation of possible cases are essential to control the epidemic, this finding suggested an urgent need to scale-up response services. Since October, there have been increases in Ebola treatment units, burial teams, and coordinated call center response at the district level that have helped to improve response capacity. Call centers can be used to improve allocation of resources, provide the public with a credible source for assistance and information, monitor programs, and possibly to assist in decreasing rates of local transmission by facilitating prompt transfer of ill persons to hospitals or Ebola treatment units and providing prompt and safe burial of persons who have died in their homes.

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Reference

1. Ebola virus disease situation report. January 11, 2015. Government of Sierra Leone, Ministry of Health and Sanitation. Vol. 228.

Notes from the Field

Outbreak of Diarrheal Illness Caused by *Shigella flexneri* — American Samoa, May–June 2014

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On May 9, 2014, a physician at hospital A in American Samoa noticed an abnormally high number of children presenting to the emergency department with bloody diarrhea. Based on preliminary testing of stool specimens, *Entamoeba histolytica* infection was suspected as a possible cause. *Shigella* was also suspected in a subset of samples. On May 22, the American Samoa Department of Health requested assistance from CDC with the outbreak investigation. The goals of the investigation were to establish the presence of an outbreak, characterize its epidemiology and etiology, and recommend control measures. The CDC field team reviewed the emergency department log book for cases of diarrheal illness during April 15–June 13, 2014. During this period, 280 cases of diarrheal illness were recorded, with a peak occurring on May 10. Twice as many cases occurred during this period in 2014 compared with the same period in 2011, the most recent year for which comparable surveillance data were available. Cases were widely distributed across the island. The highest number of cases occurred in children aged 0–9 years. Across age groups, cases were similarly distributed among males and females. These patterns are not consistent with the epidemiology of disease caused by *E. histolytica*, which tends to cause more cases in males of all ages.

Hypothesis-generating interviews with families of 13 patients did not reveal any common water, food, sewage, or event exposures. Eight participants reported having ill household contacts, with family contacts often becoming ill within 1–3 days after the participant's illness onset. Six stool specimens were sent to CDC. All were negative for ameba, including *E. histolytica*, by multiple laboratory methods. All six specimens were also negative for *Cryptosporidium* and *Giardia* by a polymerase chain reaction test. However, an invasion plasmid antigen H (ipaH) gene sequence, a genetic marker of *Shigella*, was identified in four specimens. Additionally, seven *Shigella* isolates sent to the Hawaii Department of Health and CDC were identified as *Shigella flexneri* serotype 7 (proposed; also referred to as provisional 88-893 or 1c), and five shared an indistinguishable pulsed-field gel electrophoresis pattern.

Shigella causes an estimated 500,000 cases of shigellosis per year in the United States (*1*). Most persons infected with *Shigella* develop diarrhea (sometimes bloody), fever, and stomach cramps 1–2 days after they are exposed to the bacteria. The illness usually resolves in 5–7 days. Careful and frequent hand washing and strict adherence to standard food and water safety precautions are the best defense against shigellosis (*2*).

Together, epidemiologic and laboratory data suggest this was a shigellosis outbreak with person-to-person transmission. This investigation highlights the importance of building epidemiologic and laboratory capacity for enteric illnesses and enhancing basic hand hygiene and prevention strategies in U.S. territories.

Acknowledgments

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References

1. Scallan, E, Hoekstra, RM, Angulo, FJ, et al. Foodborne illness acquired in the United States—major pathogens. Emerg Infect Dis 2011;17:7–15.
2. Heiman, KE, Bowen A. Infectious diseases related to travel: shigellosis [Chapter 3]. In: CDC health information for international travel (Yellow Book), Brunette GW, Kozarsky PE, Cohen NJ, et al (eds). New York, NY: Oxford University Press; 2014. Available at http://wwwnc.cdc.gov/travel/yellowbook/2014/chapter-3-infectious-diseases-related-to-travel/shigellosis.

Announcement

Updates to the Overseas Immunization Program for United States–Bound Refugees

Refugees being resettled in the United States, unlike immigrants seeking residency, have not been subject to immunization requirements (*1*). Without immunization, refugee communities overseas and in the United States are vulnerable to outbreaks of vaccine-preventable diseases that can disrupt the resettlement process and require costly public health responses (*2,3*). CDC's Division of Global Migration and Quarantine has regulatory authority to prevent communicable disease importation among the approximately 70,000 refugees resettled in the United States each year.

Historically, logistical challenges prevented overseas routine vaccination of refugees scheduled for resettlement in the United States. However, in December 2012, CDC began implementation of an overseas program that resulted in the routine vaccination of United States–bound refugees in six countries: Thailand and Nepal (initiated December 2012), Malaysia and Kenya (initiated September 2013), Ethiopia (initiated November 2013), and Uganda (initiated August 2014). Refugees vaccinated through this program began arriving in the United States in 2013. The program covers approximately 50% of refugees who arrive in the United States annually and likely will be expanded to include countries from which other refugees originate.

A collaboration with two other agencies (the U.S. State Department's Bureau of Population, Refugees, and Migration and the International Organization for Migration), the overseas vaccination program is intended to reduce U.S. disease outbreaks by ensuring that refugees arrive in the United States protected against vaccine-preventable diseases. Depending on age and individual risk factors, refugees now receive 2 to 3 doses of the following vaccines while overseas: polio; measles, mumps, and rubella; hepatitis B; pneumococcal conjugate; and *Haemophilus influenzae* type B. Initial doses are given during the immigration medical examination 2–6 months before departure for the United States. These vaccines were selected after considering disease risk and the cost and availability of the vaccines in refugee camp settings.

Information on participating countries and current vaccine schedules is available at http://www.cdc.gov/immigrantrefugeehealth/guidelines/overseas/interventions/immunizations-schedules.html, or by contacting CDC at dgmqpdi@cdc.gov. Vaccines administered to refugees through this program are documented in the Division of Global Migration and Quarantine's Electronic Disease Notification System and are accessible to clinics conducting postarrival refugee medical examinations (*4*). More information on the notification system is available by contacting the help desk at edn@cdc.gov.

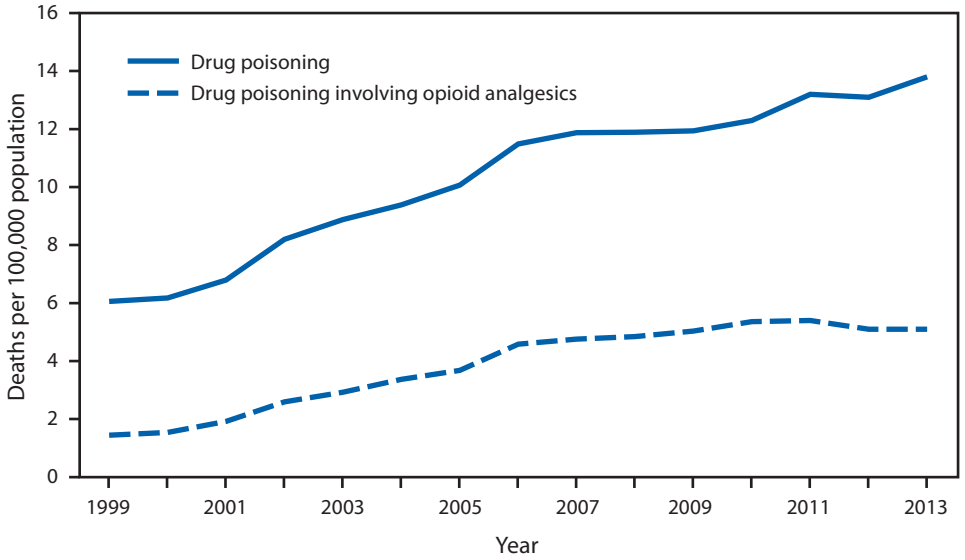
References

1. Immigration and Nationality Act section 212 (8 U.S.C. 1182)(a)(1)(A)(ii) as amended by section 341 of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996. Available at http://www.gpo.gov/fdsys/pkg/USCODE-2011-title8/html/USCODE-2011-title8-chap12-subchapII-partII-sec1182.htm.
2. CDC. U.S.-incurred costs of wild poliovirus infections in a camp with U.S.-bound refugees—Kenya, 2006. MMWR Morb Mortal Wkly Rep 2008; 57:232–5.
3. Coleman MS, Garbat-Welch L, Burke H, et al. Direct costs of a single case of refugee-imported measles in Kentucky. Vaccine 2012;30:317–21.
4. Lee D, Philen R, Wang Z, et al. Disease surveillance among newly arriving refugees and immigrants—Electronic Disease Notification System, United States, 2009. MMWR Surveill Summ 2013;62(No. SS-7).

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Rates* of Deaths from Drug Poisoning† and Drug Poisoning Involving Opioid Analgesics§ — United States, 1999–2013



* Per 100,000 population, age-adjusted to the 2000 U.S. standard population.

† Drug poisoning deaths can result from taking an overdose of a drug, being given the wrong drug, taking a drug in error, or taking a drug inadvertently. Drug poisoning deaths include all intents (i.e., unintentional, suicide, homicide, and undetermined intent).

§ Drug poisoning deaths are identified using the *International Classification of Diseases, Tenth Revision (ICD-10)* underlying cause of death codes X40–X44, X60–X64, X85, and Y10–Y14. Drug poisoning deaths involving opioid analgesics are the subset of drug poisoning deaths with a multiple cause of death code of T40.2–T40.4.

In 2013, a total of 43,982 deaths in the United States were attributed to drug poisoning, including 16,235 deaths (37%) involving opioid analgesics. From 1999 to 2013, the drug poisoning death rate more than doubled from 6.1 to 13.8 per 100,000 population, and the rate for drug poisoning deaths involving opioid analgesics nearly quadrupled from 1.4 to 5.1 per 100,000. For both drug poisoning and drug poisoning involving opioid analgesics, the death rate increased at a faster pace from 1999 to 2006 than from 2006 to 2013.

Sources: National Vital Statistics System mortality data. Available at http://www.cdc.gov/nchs/deaths.htm.

Chen LH, Hedegaard H, Warner M. Drug-poisoning deaths involving opioid analgesics: United States, 1999–2011. NCHS data brief no. 166. Hyattsville, MD: US Department of Health and Human Services, CDC; 2014. Available at http://www.cdc.gov/nchs/data/databriefs/db166.htm.

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ISSN: 0149-2195