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Children with Heart Conditions and Their Special Health Care Needs — United States, 2016

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Children with heart conditions often use more health care services and specialized care than children without a heart condition (*1*); however, little is known about the number of U.S. children with heart conditions and their special health care needs. CDC used data from the 2016 National Survey of Children's Health (NSCH) to estimate the prevalence of heart conditions among U.S. children aged 0–17 years, which indicated that 1.3% had a current heart condition and 1.1% had a past heart condition (representing approximately 900,000 and 755,000 children, respectively). Sixty percent and 40% of children with current and past heart conditions, respectively, had one or more special health care needs, compared with 18.7% of children without a heart condition (adjusted prevalence ratios [aPRs] = 3.1 and 2.1, respectively). Functional limitations were 6.3 times more common in children with current heart conditions (30.7%) than in those without heart conditions (4.6%). Among children with current heart conditions, males, children with lower family income, and children living in other than a two-parent household had an increased prevalence of special health care needs. These findings highlight the importance of developmental surveillance and screening for children with heart conditions and might inform public health resource planning.

Heart conditions in children can be congenital or acquired and range from asymptomatic to life-threatening. Congenital heart defects (CHDs) are the most common type of birth defect in the United States, affecting approximately 1% of live births (*2*). Children with CHDs often use more health care or educational services than do children without CHDs and might require specialized care (*1*,*3*,*4*). Less is known about the prevalence or needs of children with acquired heart conditions. Previously, there have been no known U.S. population-based estimates of the number of children with heart conditions or their special health care needs.

NSCH is a population-based, nationally representative survey of parents or primary caregivers (parents) of noninstitutionalized U.S. children aged 0–17 years.* NSCH asks parents about a selected child's health, health care access, and family characteristics. In 2016, a total of 364,150 households were

* https://mchb.hrsa.gov/data/national-surveys.

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sampled; 138,009 (37.9%) parents completed screener surveys, and 50,212 (36.4%) of those completed topical surveys. The overall weighted response rate was 40.7%.[†]

Parents were asked if they had ever been told by a health care provider that their child had a heart condition. Those who responded affirmatively were asked if their child currently had a heart condition. Children's heart condition status was categorized as "current," "past," or "none." Parents were also asked about their child's special health care needs using a standardized five-item screener that included 1) need for or use of medications (other than vitamins) prescribed by a doctor; 2) need for or use of medical care, mental health, or educational services beyond those of a similarly aged child (referred to as "average use"); 3) limitation in the child's ability to do things most children of the same age can do; 4) need for or use of specialized therapies such as physical, occupational, or speech therapy; and 5) need for or receipt of treatment or counseling for an emotional, behavioral, or developmental problem. If any special health care need was attributable to a medical, behavioral, or other health condition that had lasted, or was expected to last, 12 months or longer, the child was considered to have a special health care need. The questionnaire also inquired about 26 other health conditions.[§]

The numbers and percentages of children with current, past, and no heart conditions were calculated. Chi-square tests were used to examine the differences in demographic characteristics (sex, age, race/ethnicity, family income as a percentage of the federal poverty level [FPL], highest parental education level achieved, health insurance type, and household structure); other health conditions; and special health care needs, by heart condition status. Marginal prediction approach to logistic regression was used to assess the association between heart condition status and one or more special health care needs, adjusted for demographic characteristics. Among children with a current heart condition, characteristics associated with having one or more special health care needs also were examined. All analyses were repeated excluding children with Down syndrome or other genetic conditions because these children's heart conditions might be related to the syndromes. All analyses included design parameters to account for complex

[†] https://www.census.gov/content/dam/Census/programs-surveys/nsch/tech-documentation/methodology/2016-NSCH-Methodology-Report.pdf.

[§] Allergies, anxiety problems, arthritis, asthma, attention deficit disorder/attention deficit hyperactivity disorder, autism spectrum disorder, behavioral/conduct problems, blood disorders, brain injury, cerebral palsy, cystic fibrosis, depression, developmental delay, diabetes, Down syndrome, epilepsy/seizure disorder, headaches/migraines, hearing impairment, learning disability, mental retardation/intellectual disability, other genetic/inherited conditions, other mental health conditions, speech/language disorder, substance abuse, Tourette syndrome, and vision impairment.

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sampling and weights to generate population-based estimates of the numbers and prevalences of children with and without heart conditions.

Among the 50,212 children in the sample, 1,733 (3.5%) were excluded from analysis because of missing information, including heart condition status (180), special health care needs (309), and demographic characteristics (1,244). Excluded children were more commonly nonwhite, not privately insured, and living in households with lower income, lower parental education level, and other than two parents than were children who were not excluded (p<0.05 for all). After weighting the data to represent the U.S. population of children 0–17 years, an estimated 900,000 U.S. children (1.3% of U.S. children; 95% confidence interval [CI] = 1.1–1.5) had a current heart condition, 755,000 children (1.1%; 95% CI = 0.9–1.3) had a past heart condition, and 68.1 million children (97.6%; 95% CI = 97.3–97.9) had no heart condition.

Among children with current heart conditions, 58.3% were male, 55.7% were non-Hispanic white, 21.5% had family income <100% of FPL, 64.8% had at least one parent with higher than a high school education, 72.3% lived in a two-parent household, and 55.4% had private health insurance (Table 1). Demographic characteristics did not differ by heart condition status. Among children with current and past heart conditions, 67.2% and 60.5%, respectively, had one or more other health conditions, compared with 46.7% of children with no heart condition (p<0.001).

Sixty percent of children with current heart conditions and 40.0% with past heart conditions had one or more special health care needs, compared with 18.7% of children without a heart condition (Table 2). Children with heart conditions most commonly needed or used prescription medicines (current = 42.8%; past = 26.6%) and had above average use of medical care, mental health, or educational services (current = 41.8%; past = 23.9%). Children with current or past heart conditions were 3.1 and 2.1 times more likely, respectively, to have one or more special health care needs than were children without a heart condition, with the

TABLE 1. Characteristics of children aged 0–17 years, by parent-reported heart condition status — National Survey of Children's Health, United States, 2016

	Heart condition status						
	Current		Past		None		
Characteristic	Unweighted no.	Weighted % (95% CI)	Unweighted no.	Weighted % (95% CI)	Unweighted no.	Weighted % (95% CI)	Chi- square p value
Total	**634**	—	**498**	—	**47,347**	—	—
Sex							
Male	356	58.3 (50.0–66.1)	267	53.5 (42.6–64.1)	24,189	50.8 (49.8–51.8)	0.17
Female	278	41.7 (33.9–50.0)	231	46.5 (35.9–57.4)	23,158	49.2 (48.2–50.2)	
Age group (yrs)							
0–5	185	28.9 (22.9–35.7)	136	27.9 (20.5–36.7)	13,717	32.4 (31.5–33.4)	0.16
6–11	194	44.0 (35.9–52.4)	144	32.7 (23.2–43.7)	14,139	33.9 (32.9–34.9)	
12–17	255	27.1 (21.6–33.5)	218	39.5 (29.1–50.9)	19,491	33.7 (32.8–34.6)	
Race/Ethnicity							
White, non-Hispanic	455	55.7 (47.3–63.8)	356	52.0 (41.0–62.8)	33,510	52.5 (51.5–53.6)	0.75
Other*	179	44.3 (36.2–52.7)	142	48.0 (37.2–59.0)	13,837	47.5 (46.4–48.5)	
Family income as a percentage of federal poverty level†							
<100%	72	21.5 (15.5–28.9)	58	28.7 (17.6–43.3)	4,309	20.5 (19.5–21.5)	0.28
100%–199%	112	27.4 (19.6–36.8)	81	19.4 (13.2–27.6)	7,375	21.9 (21.0–22.9)	
200%–399%	208	27.4 (21.8–33.9)	169	27.6 (20.6–36.0)	14,693	27.2 (26.3–28.0)	
≥400%	242	23.7 (18.7–29.7)	190	24.2 (17.6–32.3)	20,970	30.4 (29.6–31.2)	
Parental education level§							
High school graduate or less	107	35.2 (26.9–44.6)	77	29.3 (19.9–40.9)	6,772	28.4 (27.3–29.6)	0.38
More than high school	527	64.8 (55.4–73.1)	421	70.7 (59.1–80.1)	40,575	71.6 (70.4–72.7)	
Household structure							
Two parents	503	72.3 (65.1–78.5)	393	77.6 (69.6–83.9)	38,606	75.8 (74.9–76.7)	0.54
Other	131	27.7 (21.5–34.9)	105	22.4 (16.1–30.4)	8,741	24.2 (23.3–25.1)	
Insurance type¶							
Any private	459	55.4 (47.0–63.5)	354	50.7 (39.9–61.5)	36,679	61.6 (60.5–62.6)	0.10
Public, unspecified, or uninsured	173	44.6 (36.5–53.0)	141	49.3 (38.5–60.1)	10,544	38.4 (37.4–39.5)	

Abbreviation: CI = confidence interval.
* Includes Hispanic, non-Hispanic black, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and Asian.
† Based on the U.S. Department of Health and Human Services Poverty Guidelines.
§ Highest education level among two parents or child's primary caregivers.
¶ 129 had missing information on insurance type.

TABLE 2. Percentage and adjusted prevalence ratio* of special health care needs† among children aged 0–17 years, by parent-reported heart condition status — National Survey of Children's Health, United States, 2016

	Heart condition status				
	Current		Past		None
Special health care needs	% (95% CI)	aPR* (95% CI)	% (95% CI)	aPR* (95% CI)	% (95% CI)
Has one or more special health care needs	60.0 (51.6–67.8)	3.1 (2.7–3.6)	40.0 (29.9–50.9)	2.1 (1.6–2.7)	18.7 (18.0–19.5)
Needs or uses prescription medicines	42.8 (35.3–50.7)	3.0 (2.5–3.6)	26.6 (17.5–38.1)	1.9 (1.3–2.8)	13.8 (13.2–14.5)
Above average use of health care or educational services§	41.8 (34.5–49.4)	4.2 (3.5–5.1)	23.9 (17.2–32.2)	2.4 (1.8–3.3)	9.5 (9.0–10.1)
Has functional limitations	30.7 (24.3–38.0)	6.3 (5.0–8.1)	17.4 (11.5–25.5)	3.7 (2.4–5.6)	4.6 (4.1–5.0)
Needs or uses physical, occupational, or speech therapies	22.4 (16.9–29.0)	4.3 (3.2–5.7)	14.4 (9.2–21.8)	2.9 (1.8–4.6)	4.7 (4.3–5.2)
Needs or receives treatment or counseling for emotional, developmental or behavioral conditions	23.4 (17.8–30.0)	2.7 (2.1–3.5)	22.5 (15.9–30.9)	2.7 (1.9–3.8)	8.0 (7.5–8.5)

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval.
* Prevalence ratio of special health care needs for current and past heart conditions versus no heart condition, adjusted for sex, age group, race/ethnicity, family income as a percentage of the federal poverty level, parental education level, and household structure.
† Based on having one or more of the following five conditions: needing or using prescription medicine; needing or using more medical care, mental health, or educational services than other children their age; having limitations in doing things, compared with other children their age; needing special therapy (e.g., physical, occupational, or speech therapy); or having an emotional, developmental, or behavioral problem in need of counseling or treatment. These conditions must be related to a medical, behavioral, or other health condition that has lasted or is expected to last 12 months or longer.
§ Beyond those of a similarly aged child.

largest relative differences observed for functional limitations (current aPR = 6.3; 95% CI = 5.0–8.1) (past aPR = 3.7; 95% CI = 2.4–5.6).

Among children with current heart conditions, an increased prevalence of special health care needs was observed among males (aPR = 1.3; 95% CI = 1.1–1.7), children with family income <100% of FPL (aPR = 1.4; 95% CI = 1.0–2.0), and children living in other than a two-parent household (aPR = 1.3; 95% CI = 1.0–1.6) (Table 3). Findings did not change substantially after excluding 1,650 children with Down syndrome or other genetic conditions, 181 (11%) of whom had a heart condition.

Discussion

According to the 2016 NSCH, 1.3% and 1.1% of U.S. children had a current or past heart condition, respectively. Because the specific types of heart conditions were unknown (i.e., congenital versus acquired), comparing current findings with published estimates of CHDs or acquired heart conditions is difficult. The birth prevalence of CHDs is nearly 1%, and approximately 1 million U.S. children have CHDs (*2*). Although U.S. estimates of some acquired heart diseases such as those resulting from Kawasaki disease (*5*) and rheumatic heart disease (*6*) exist, the prevalence of other acquired heart conditions in children is unknown.

Children with CHDs are at increased risk for developmental disabilities and speech, motor, behavior, or learning problems (*1*), whereas the risk for children with acquired heart conditions has not been quantified. The higher prevalence of special health care needs among children with heart conditions, particularly

TABLE 3. Associations between selected demographic characteristics and special health care needs among children aged 0–17 years who have a current heart condition — National Survey of Children's Health, United States, 2016

	One or more special health care needs	
Characteristic	Weighted % (95% CI)	aPR* (95% CI)
Sex		
Male	68.9 (60.5–76.3)	1.3 (1.1–1.7)
Female	47.4 (34.5–60.7)	Referent
Age group (yrs)		
0–5	57.8 (45.9–68.9)	Referent
6–11	58.5 (42.7–72.7)	1.0 (0.7–1.2)
12–17	64.4 (53.4–74.4)	1.1 (0.9–1.3)
Race/Ethnicity		
White, non-Hispanic	62.4 (54.6–69.7)	Referent
Other†	56.8 (41.3–71.1)	0.9 (0.7–1.1)
Family income as a percentage of federal poverty level§		
<100%	80.5 (67.3–89.3)	1.4 (1.0–2.0)
100%–199%	52.8 (32.6–72.2)	1.0 (0.7–1.5)
200%–399%	59.5 (47.8–70.2)	1.1 (0.9–1.5)
≥400%	50.1 (38.5–61.7)	Referent
Parental education level¶		
High school graduate or less	62.0 (41.6–78.9)	1.0 (0.8–1.3)
More than high school	58.8 (51.6–65.7)	Referent
Household structure		
Two parents	54.2 (44.2–63.8)	Referent
Other	75.1 (63.3–84.0)	1.3 (1.0–1.6)

Abbreviations: aPR = adjusted prevalence ratio. CI = confidence interval.
* Prevalence ratios adjusted for sex, age group, race/ethnicity, family income, parental education level, and household structure.
† Includes Hispanic, non-Hispanic black, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and Asian.
§ Based on the U.S. Department of Health and Human Services Poverty Guidelines.
¶ Highest education level among two parents or child's primary caregivers.

Summary

What is already known about this topic?

Children with heart conditions often need specialized care. Little is known about the number of U.S. children living with heart conditions and their special health care needs.

What is added by this report?

In 2016, 1.3% of U.S. children had a current heart condition, and 1.1% had a past heart condition. Children with past and current heart conditions had higher prevalences of one or more special health care needs, compared with children without heart conditions.

What are the implications for public health practice?

These findings highlight the importance of developmental surveillance and screening among children with heart conditions for early identification and intervention and could inform public health resource planning.

functional limitations identified in this study, supports the American Academy of Pediatrics' guidance on developmental surveillance and screening for early identification and intervention (*7*), particularly for children with complex CHDs (e.g. single ventricle defects) (*1*).

Similar to the present findings among children with CHDs, male sex, lower family income, and other than two-parent household structure have been associated with special health care needs in the general pediatric population (*8*). The differences in the prevalence of special health care needs by sex, family income, and household structure could reflect a difference in health status or differential ascertainment. Associations between special health care needs and family income and household structure might be attributable to stress and financial issues associated with the child's health and treatment (*9*). More information is needed to know what resources might support families and benefit children.

The findings in this report are subject to at least five limitations. First, data are parent-reported and unconfirmed by medical records; however, according to findings from a study that used medical records to verify parental report of a diagnosis of autism (*10*), parental report of their child's medical history might be valid. Second, separate analyses for congenital, acquired, or other heart conditions could not be conducted because information on the type of heart condition was not available. Third, the composition of heart conditions relies on what the responding parent considered a "heart condition" or a "current heart condition," which might underestimate or overestimate the prevalence of heart conditions. Fourth, although the data were weighted for nonresponse, bias might remain. Finally, the temporality of special health care needs and family income or household structure is unknown.

These first population-based prevalence estimates of children with heart conditions and their special health care needs highlight the importance of guidelines for developmental surveillance and screening for early identification and intervention (*4*,*7*). These estimates could inform national and state child health programs to ensure that children with heart conditions receive necessary services.

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Influenza Vaccination Coverage Among Health Care Personnel — United States, 2017–18 Influenza Season

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The Advisory Committee on Immunization Practices (ACIP) recommends that all health care personnel receive an annual influenza vaccination to reduce influenza-related morbidity and mortality among health care personnel and their patients and to reduce absenteeism among health care personnel (*1*–*4*). CDC conducted an opt-in Internet panel survey of 2,265 U.S. health care personnel to estimate influenza vaccination coverage among these persons during the 2017–18 influenza season. Overall, 78.4% of health care personnel reported receiving influenza vaccination during the 2017–18 season, similar to reported coverage in the previous four influenza seasons (*5*). As in previous seasons, coverage was highest among personnel who were required by their employer to be vaccinated (94.8%) and lowest among those working in settings where vaccination was not required, promoted, or offered on-site (47.6%). Health care personnel working in long-term care settings, the majority of whom work as assistants or aides, have lower influenza vaccination coverage than do health care personnel working in all other health care settings, which puts the elderly in long-term settings at increased risk for severe complications for influenza. Implementing workplace strategies shown to improve vaccination coverage among health care personnel, including vaccination requirements and active promotion of on-site vaccinations at no cost, can help ensure health care personnel and patients are protected against influenza (*6*). CDC's long-term care web-based toolkit* provides resources, strategies, and educational materials for increasing influenza vaccination among health care personnel in long-term care settings.

An Internet panel survey of health care personnel was conducted for CDC during March 27–April 17, 2018, to provide estimates of influenza vaccination coverage among health care personnel during the 2017–18 influenza season. Similar surveys have been conducted since the 2010–11 influenza season, and survey methodology has been described previously (*7*). Respondents were recruited from two preexisting national opt-in Internet sources: Medscape, a medical website managed by WebMD Health Professional Network,† and general population Internet panels operated by Survey Sampling International (SSI).§ Responses were weighted to the distribution of the U.S. population of health care personnel by occupation, age, sex, race/ethnicity, work setting, and Census region.¶ Because the study sample was based on health care personnel from opt-in Internet panels rather than probability samples, statistical tests were not conducted.** A change was considered an increase or decrease when there was at least a 5 percentage-point difference between estimates; estimates with smaller differences were considered similar.

Among the 2,382 persons who started the survey from either source (Medscape or SSI) and had eligible responses to the screening questions, 2,310 (97.0%) completed the survey.†† Forty-three respondents with completed surveys who reported working in "other health care settings" were excluded because examination of their other survey responses indicated that they were either unlikely to have contact with patients or unlikely to have worked in one of the health care settings of interest for this analysis; two additional respondents were excluded because their work locations were outside of the United States. The final analytic sample included 2,265 health care personnel.

Overall, 78.4% of health care personnel reported having received an influenza vaccination during the 2017–18 season, a 15 percentage-point increase since the 2010–11

* https://www.cdc.gov/flu/toolkit/long-term-care/index.htm.

† Physicians, nurse practitioners, physician assistants, nurses, dentists, pharmacists, allied health professionals, technicians, and technologists were recruited from the current membership roster of Medscape. Additional information on Medscape is available at https://www.medscape.com.

§ Assistants, aides, and nonclinical personnel (such as administrators, clerical support workers, janitors, food service workers, and housekeepers) were recruited from general population Internet panels operated by Survey Sampling International. Additional information on Survey Sampling International and its incentives for online survey participants is available at https://www.surveysampling.com.

¶ Population control totals of U.S. health care personnel by occupation and work setting were obtained from the Bureau of Labor Statistics, U.S. Department of Labor, Occupational Employment Statistics, May 2016 National Industry-Specific Occupational Employment and Wage Estimates (https://www.bls.gov/oes/current/oessrci.htm). Population control totals by other demographic characteristics were obtained from the U.S. Census Bureau, Current Population Survey Monthly Labor Force Data, September 2017 (https://www.bls.gov/cps/data.htm).

** Additional information on obstacles to inference in nonprobability samples is available at: https://www.aapor.org/AAPOR_Main/media/MainSiteFiles/NPS_TF_Report_Final_7_revised_FNL_6_22_13.pdf and https://www.aapor.org/getattachment/Education-Resources/For-Researchers/AAPOR_Guidance_Nonprob_Precision_042216.pdf.aspx. While the estimates reported here have variance, there has been no attempt to quantify the size of the variance.

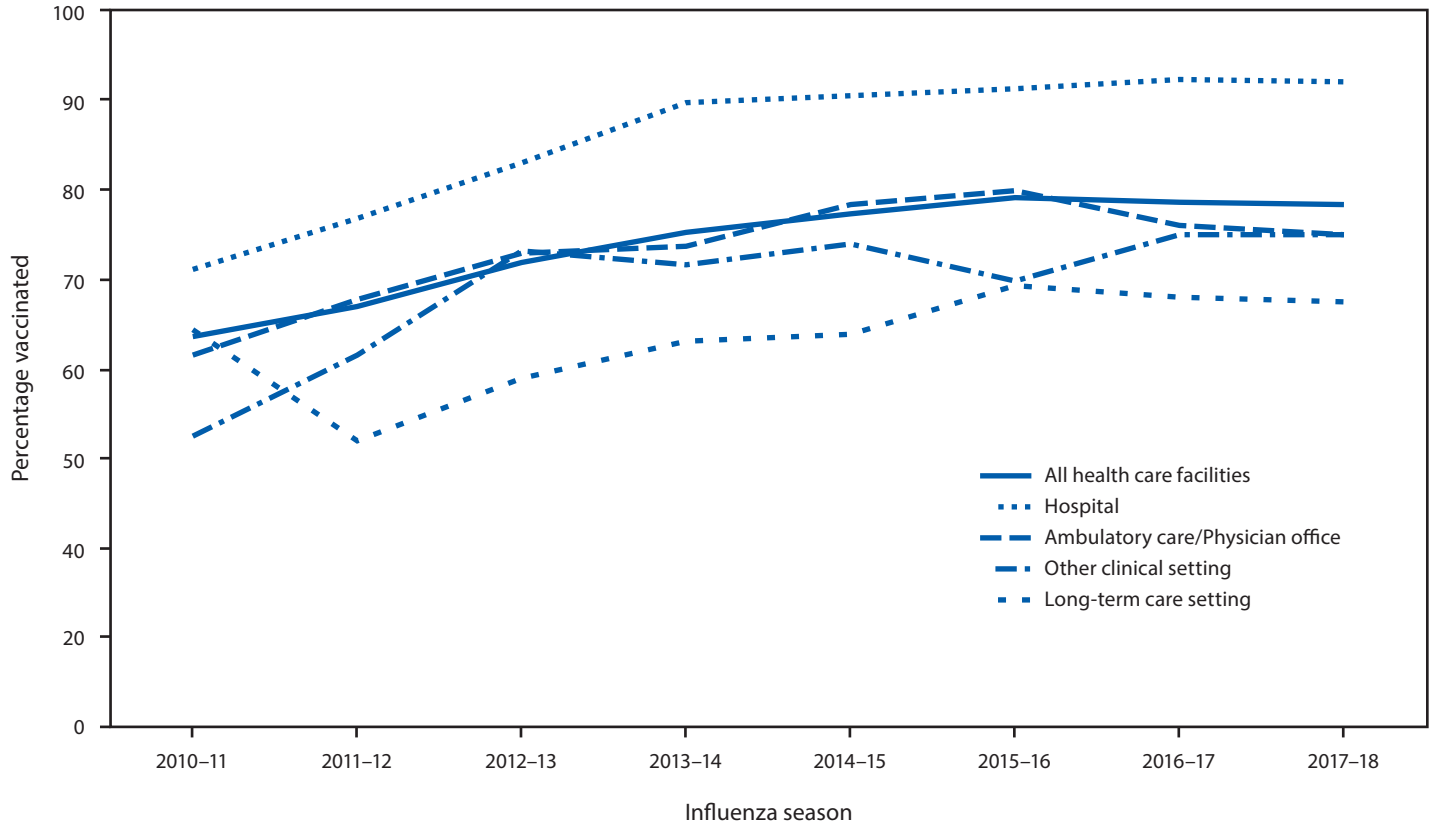
†† A survey response rate requires specification of the denominator at each stage of sampling. During recruitment of an online opt-in survey sample, such as the Internet panels described in this report, these numbers are not available; therefore, a response rate cannot be calculated. Instead, the survey completion rate is provided.

season but similar to coverage in the previous four seasons (75.2%–78.6%) (Figure 1) (Figure 2). Vaccination coverage in the 2017–18 season was similar to that in the 2016–17 season among health care personnel in all work settings (Figure 1) and occupation groups (Figure 2). As in previous seasons, coverage in the 2017–18 season was highest among health care personnel working in hospital settings (91.9%) followed by those working in ambulatory care (75.1%), other clinical settings (74.9%), and long-term care settings (67.4%) (Figure 1). Overall, vaccination coverage in 2017–18 was higher among physicians (96.1%), pharmacists (92.2%), nurses (90.5%), and nurse practitioners and physician assistants (87.8%), and lower among other clinical health care personnel (80.9%), assistants and aides (71.1%), and nonclinical health care personnel (72.8%) (Figure 2).

Vaccination coverage was highest (94.8%) among health care personnel working in settings where vaccination was required (Table). Overall, 44.1% of health care personnel reported a requirement to be vaccinated; those working in hospitals were more likely to report a vaccination requirement (68.3%) than were those working in ambulatory care (39.2%), long-term care (29.6%), or other clinical settings (37.9%) (Table). Among health care personnel whose employers did not have a requirement for vaccination, coverage was higher among those who worked in locations where vaccination was offered at the worksite at no cost for 1 day only (70.4%) or >1 day (76.0%) or who worked in locations where their employer did not provide influenza vaccination on-site at no cost but actively promoted vaccination through other mechanisms[§§] (75.1%) compared with that among health care personnel working in locations where employers did not have any vaccination-related

[§§] Employer promoted influenza vaccination among employees through public identification of vaccinated persons, financial incentives or rewards to individual persons or groups of employees, competition between units or care areas, free or subsidized cost of vaccination, personal reminders to be vaccinated, or publicizing of the number or percentage of employees receiving vaccination.

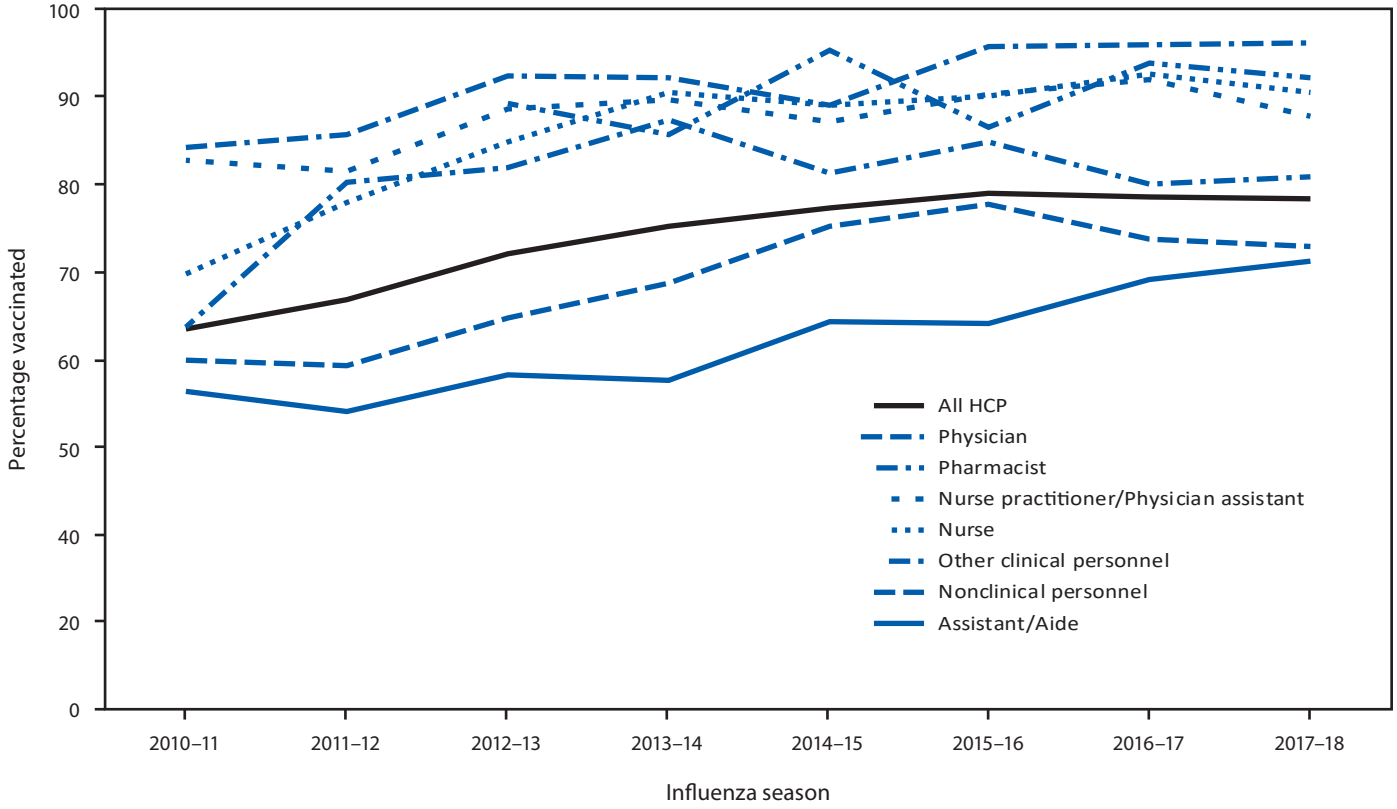
FIGURE 1. Percentage of health care personnel who received influenza vaccination, by work setting* — Internet panel surveys,† United States, 2010–11 through 2017–18 influenza seasons



* Respondents could select more than one work setting. The "ambulatory care/physician office" category includes physician's office, medical clinic, and other ambulatory care settings. The "other clinical setting" category includes dentist office or dental clinic, pharmacy, laboratory, public health setting, emergency medical services setting, or other setting where clinical care or related services were provided to patients.

† Respondents were recruited from two preexisting national opt-in Internet sources: Medscape, a medical website managed by WebMD Health Professional Network, and general population Internet panels operated by Survey Sampling International.

FIGURE 2. Percentage of health care personnel (HCP) who received influenza vaccination, by occupation* — Internet panel surveys,† United States, 2010–11 through 2017–18 influenza seasons



* In the 2010–11 season, dentists were included in the physician category. Before the 2012–13 season, separate data on pharmacists were not collected. Other clinical personnel category includes allied health professionals, technicians, and technologists. Nonclinical personnel category includes administrative support staff members or managers and nonclinical support staff members (e.g., food service workers, laundry workers, janitors, and other housekeeping and maintenance staff members).
† Respondents were recruited from two preexisting national opt-in Internet sources: Medscape, a medical website managed by WebMD Health Professional Network, and general population Internet panels operated by Survey Sampling International.

requirements or provisions (47.6%) (Table). Health care personnel working in hospital settings were less likely to report that their employer did not require, provide, or promote vaccination (2.1%) than were personnel working in ambulatory care, long-term care, and other clinical settings (23.2%, 23.5%, and 26.1%, respectively).

Discussion

The overall influenza vaccination coverage estimate among health care personnel was 78.4% during the 2017–18 influenza season, a 15 percentage-point increase since the 2010–11 season, but similar to coverage during the previous four seasons (*5*). As in past seasons, the highest coverage was associated with workplace vaccination requirements. Reported coverage was consistently higher among health care personnel working in hospital settings than among those working in other settings; health care personnel working in hospital settings were also the most likely to report workplace vaccination requirements. Influenza vaccination coverage was higher among health care personnel with vaccination available at or promoted in their workplace than among those without any type of employer promotion of vaccination; however, coverage achieved through vaccine availability and promotion was still suboptimal in the absence of requirements. Neither vaccination coverage nor prevalence of employer vaccination requirements or promotion differed in the 2017–18 season compared with the previous season (*5*), despite the severity of the 2017–18 influenza season (*8*).

Influenza vaccination coverage among health care personnel working in long-term care settings, the majority of whom work as assistants and aides (*5*,*7*), continues to be consistently lower than that among health care personnel working in all other health care settings. Influenza vaccination among health care personnel in long-term care settings is especially important because influenza vaccine efficacy is generally lowest among the elderly, who are at increased risk for severe disease (*2*). In contrast to health care personnel working in hospitals, a much lower proportion of survey respondents working in long-term

TABLE. Percentage of health care personnel* who received influenza vaccination, by employer vaccination requirements, workplace vaccine availability, and work setting — Internet panel surveys,† United States, 2017–18 influenza season

Vaccination requirement and availability/Work setting	No. (weighted %§)	Weighted % vaccinated
Employer vaccination requirement¶	**921 (44.1)**	**94.8**
Hospital	572 (68.3)	96.6
Ambulatory care/Physician office**	267 (39.2)	91.2
Long-term care	161 (29.6)	89.3
Other clinical setting††	200 (37.9)	90.1
On-site vaccination >1 day§§	**380 (14.3)**	**76.0**
Hospital	97 (14.8)	85.2
Ambulatory care/Physician office**	101 (13.1)	79.1
Long-term care	76 (13.9)	59.4
Other clinical setting††	155 (15.4)	76.7
On-site vaccination 1 day¶¶	**315 (14.6)**	**70.4**
Hospital	62 (11.5)	80.3
Ambulatory care/Physician office**	91 (16.0)	70.1
Long-term care	101 (17.4)	67.4
Other clinical setting††	91 (9.4)	67.0
Other vaccination promotion***	**218 (9.6)**	**75.1**
Hospital	20 (3.3)	—†††
Ambulatory care/Physician office**	42 (8.4)	74.2
Long-term care	94 (15.6)	70.4
Other clinical setting††	76 (11.2)	74.0
No requirement, on-site vaccination or promotion	**431 (17.4)**	**47.6**
Hospital	31 (2.1)	39.9
Ambulatory care/Physician office**	120 (23.2)	49.4
Long-term care	148 (23.5)	42.4
Other clinical setting††	166 (26.1)	54.9

* Persons who worked in a place where clinical care or related services were provided to patients, or whose work involved face-to-face contact with patients or who were ever in the same room as patients.
† Respondents were recruited from two preexisting national opt-in Internet sources: Medscape, a medical website managed by WebMD Health Professional Network, and general population Internet panels operated by Survey Sampling International.
§ Weights were calculated based on each occupation type, by age, sex, race/ethnicity, work setting, and U.S. Census region to represent the U.S. population of health care personnel. Work setting and overall occupation are presented as weighted estimates of the total sample. Where the groups are stratified by work setting, the estimates are presented as weighted estimates of the occupation group subsample of each work setting subgroup.
¶ Includes all respondents who indicated that their employer required them to be vaccinated for influenza.
** Ambulatory care (physician's office, medical clinic, and other ambulatory care setting).
†† Dentist office or dental clinic, pharmacy, laboratory, public health setting, health care education setting, emergency medical services setting, or other setting where clinical care or related services was provided to patients.
§§ Employer made influenza vaccination available on-site for >1 day during the influenza season at no cost to employees. Restricted to respondents without an employer requirement for vaccination.
¶¶ Employer made influenza vaccination available on-site for 1 day during the influenza season at no cost to employees. Restricted to respondents without an employer requirement for vaccination.
*** Influenza vaccination was promoted among employees through public identification of vaccinated persons, financial incentives, or rewards to individuals or groups of employees, competition between units or care areas, free or subsidized cost of vaccination, personal reminders to be vaccinated, or publicizing of the number or percentage of employees receiving vaccination. Restricted to respondents without an employer requirement for vaccination or on-site vaccination.
††† Vaccination coverage estimate not reliable because the sample size was <30.

Summary

What is already known about this topic?

Annual influenza vaccination is recommended for health care personnel to reduce influenza-related morbidity and mortality.

What is added by this report?

Opt-in Internet panel survey-assessed influenza vaccination coverage among health care personnel during the 2017–18 season was 78.4%, similar to the previous four seasons. Employer vaccination requirements and offering/promoting workplace vaccination were associated with higher coverage; coverage was lowest among long-term care setting personnel, who were least likely to report employer vaccination requirements or workplace vaccine availability/promotion.

What are the implications for public health practice?

Implementing comprehensive evidence-based worksite intervention strategies is important to ensure health care personnel and patients are protected against influenza. To protect the elderly from severe influenza complications, CDC tools are available for increasing vaccination among long-term care setting personnel.

care settings reported having a requirement for vaccination, and 23.5% reported that their employer did not require, make available on-site at no cost, or promote vaccination in any way. Implementing workplace vaccination programs that have been successful in increasing coverage in hospital settings, including vaccination requirements, could increase coverage in long-term care and other settings with historically lower vaccination coverage.

The findings in this report are subject to at least three limitations. First, the study used a nonprobability sample of volunteer members of Medscape and SSI Internet panels. Second, vaccination status was self-reported and might be subject to recall bias. Finally, coverage findings from Internet survey panels have differed from population-based estimates from the National Health Interview Survey in past influenza seasons, although trends in coverage were similar across seasons (*9*,*10*).

The highest influenza vaccination coverage among health care personnel continues to be reported in worksites with employer requirements for vaccination. Numerous professional medical associations, including the American Medical Directors Association, the Society for Healthcare Epidemiology of America, the American Hospital Association, the American College of Physicians, the American Nurses Association, and the American Pharmacists Association support mandatory influenza vaccination requirements for health care personnel.¶¶

¶¶ Position statements of professional organizations that endorse influenza vaccination requirements for health care personnel can be found at: http://www.immunize.org/honor-roll/influenza-mandates/. The statement of the American Nurses Association can be found at: https://www.nursingworld.org/~49177c/globalassets/docs/ana/executivesummarypositionstatement_immunizations.pdf.

In the absence of vaccination requirements, recommendations found in the Guide to Community Preventive Services, which include actively promoted on-site vaccination at no or low cost, can increase influenza vaccination coverage among health care personnel (*6*), although promotional activities generally do not attain the levels of coverage achieved by vaccination requirements. Long-term care employers can use CDC's long-term care web-based toolkit, which provides access to resources, strategies, and educational materials for increasing influenza vaccination among health care personnel and reducing influenza-associated morbidity and mortality among patients in long-term care settings.

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All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Influenza and Tdap Vaccination Coverage Among Pregnant Women — United States, April 2018

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Vaccinating pregnant women with influenza and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccines can reduce the risk for influenza and pertussis for themselves and their infants. The Advisory Committee on Immunization Practices (ACIP) recommends that all women who are or might be pregnant during the influenza season receive influenza vaccine, which can be administered any time during pregnancy (*1*). The ACIP also recommends that women receive Tdap during each pregnancy, preferably from 27 through 36 weeks' gestation (*2*). To assess influenza and Tdap vaccination coverage among women pregnant during the 2017–18 influenza season, CDC analyzed data from an Internet panel survey conducted during March 28–April 10, 2018. Among 1,771 survey respondents pregnant during the peak influenza vaccination period (October 2017–January 2018), 49.1% reported receiving influenza vaccine before or during their pregnancy. Among 700 respondents who had a live birth, 54.4% reported receiving Tdap during their pregnancy. Women who reported receiving a provider offer of vaccination had higher vaccination coverage than did women who received a recommendation but no offer and women who did not receive a recommendation. Reasons for nonvaccination included concern about effectiveness of the influenza vaccine and lack of knowledge regarding the need for Tdap vaccination during every pregnancy. Provider offers or referrals for vaccination in combination with patient education could reduce missed opportunities for vaccination and increase vaccination coverage among pregnant women.

An Internet panel* survey was conducted to assess end-of-season influenza vaccination coverage and Tdap coverage estimates among women pregnant during the 2017–18 influenza season, as previously described (*3*,*4*). The survey was conducted during March 28–April 10, 2018, among women aged 18–49 years who reported being pregnant at any time since August 1, 2017, through the date of the survey. Among 14,858 women who entered the survey site, 2,342 reported they were eligible, and of these, 2,236 completed the survey (cooperation rate = 95.5%).† Data were weighted to reflect the age, race/ethnicity, and geographic distribution of the total U.S. population of pregnant women. Analysis of influenza vaccination coverage was limited to 1,771 women who reported being pregnant any time during the peak influenza vaccination period (October 2017–January 2018). A woman was considered to have been vaccinated against influenza if she reported receiving a dose of influenza vaccine (before or during her most recent pregnancy) since July 1, 2017. To accommodate the optimal timing for Tdap vaccination during 27 through 36 weeks' gestation, analysis of Tdap coverage was limited to women who reported being pregnant any time since August 1, 2017, and who had a live birth. A woman was considered to have received Tdap if she reported receiving a dose of Tdap vaccine during her most recent pregnancy. Among 815 women who had a live birth, 115 (14.1%) were excluded from analysis because they did not know if they had ever received Tdap vaccination (11.4%) or did not know if the Tdap vaccine was received during their pregnancy (2.7%), leaving a final analytic sample of 700. An estimate of the proportion of pregnant women who received both recommended maternal vaccines was assessed among these 700 women. A difference was noted as an increase or decrease when there was a ≥5 percentage-point difference between any values being compared.§

Among pregnant women, 49.1% reported receiving a dose of influenza vaccine since July 1, 2017 (Table); Tdap coverage during pregnancy was 54.4% among women with a recent live birth. Receipt of both influenza and Tdap vaccines (i.e., being fully vaccinated) was reported by 32.8% of women with a recent live birth (Figure 1). Influenza vaccination coverage increased with increasing number of provider visits since July 1, 2017, ranging from 18.1% (0 visits) to 56.8% (>10 visits) (Table).

Among women pregnant any time during October 2017–January 2018, 66.6% reported receiving a provider offer of influenza vaccination, 14.5% received a recommendation but no offer, and 19.0% received no recommendation (Table). The percentages of women in these groups who received influenza

* https://www.surveysampling.com.

† An opt-in Internet panel survey is a nonprobability sampling survey. The denominator for a response rate calculation cannot be determined because no sampling frame with a selection probability is involved at the recruitment stage. Instead, the survey cooperation rate is provided.

§ Additional information on obstacles to inference in nonprobability samples is available at: https://www.aapor.org/AAPOR_Main/media/MainSiteFiles/NPS_TF_Report_Final_7_revised_FNL_6_22_13.pdf and https://www.aapor.org/getattachment/Education-Resources/For-Researchers/AAPOR_Guidance_Nonprob_Precision_042216.pdf.aspx. Although the estimates reported here have variance, there has been no attempt to quantify the size of the variance.

TABLE. Influenza and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccination (Tdap) coverage among pregnant women, by selected characteristics — Internet panel survey, United States, April 2018

Characteristic	Influenza*		Tdap†	
	No. (weighted %)	Vaccinated, weighted %	No. (weighted %)	Vaccinated, weighted %
Total	**1,771 (100.0)**	**49.1**	**700 (100.0)**	**54.4**
Vaccinated before pregnancy	213 (—)	12.3	N/A	N/A
Vaccinated during pregnancy	681 (—)	36.8	396 (—)	54.4
Age group (yrs)				
18–24	345 (25.3)	42.7§	126 (24.1)	49.0
25–34	1,064 (55.4)	50.5	444 (57.5)	57.9§
35–49¶	362 (19.3)	53.4	130 (18.4)	50.6
Race/Ethnicity**				
White, non-Hispanic¶	1,167 (50.4)	52.5	502 (57.3)	59.3
Black, non-Hispanic	192 (18.9)	35.6§	65 (16.6)	42.9§
Hispanic	270 (23.6)	51.3	78 (18.7)	48.8§
Other, non-Hispanic	142 (7.1)	53.0	55 (7.4)	56.5
Education				
≤High school diploma	385 (24.2)	41.8§	145 (22.7)	46.2§
Some college, no degree	429 (24.9)	40.0§	192 (28.1)	54.5
College degree	704 (37.9)	56.0	274 (37.3)	57.8
>College degree¶	253 (12.9)	59.7	89 (11.9)	59.0
Marital status				
Married¶	1,101 (56.7)	56.9	471 (62.7)	58.6
Unmarried	670 (43.3)	38.8§	229 (37.3)	47.4§
Insurance coverage††				
Private/Military only¶	939 (50.1)	55.3	369 (50.0)	58.8
Any public	752 (44.9)	44.2§	314 (47.3)	50.8§
No insurance	80 (5.0)	30.1§	<30 (—§§)	—§§
Employment status¶¶				
Working¶	959 (53.7)	53.5	330 (46.8)	52.9
Not working	812 (46.3)	43.9§	370 (53.2)	55.8
Poverty status***				
At or above poverty¶	1,416 (77.3)	52.0	538 (73.5)	58.3
Below poverty	352 (22.7)	38.8§	162 (26.5)	43.7§
High-risk condition†††				
Yes¶	651 (42.5)	54.0	N/A	N/A
No	887 (57.5)	46.3§	N/A	N/A
No. of provider visits since July 2017				
None	30 (1.8)	18.1§	N/A	N/A
1–5	385 (22.3)	37.4§	N/A	N/A
6–10	677 (38.8)	49.9§	N/A	N/A
>10¶	679 (37.0)	56.8	N/A	N/A
Provider vaccination recommendation/offer§§§				
Offered¶	1,189 (66.6)	63.8	489 (67.4)	73.5
Recommended with no offer	244 (14.5)	37.6§	78 (11.9)	38.3§
Recommended with no offer, referral received	108 (6.1)	47.9§	39 (6.3)	56.1§
Recommended with no offer, no referral received	136 (8.4)	30.1§	39 (5.7)	18.5§
No recommendation	308 (19.0)	9.0§	133 (20.7)	1.6§

See table footnotes on next page.

vaccine were 63.8%, 37.6%, and 9.0%, respectively. Among women who reported that their provider recommended but did not offer influenza vaccination, 42.1% received a referral¶ to get vaccinated elsewhere. Women with a referral were more likely to receive an influenza vaccination (47.9%) than were women who received a provider recommendation but did not receive a referral (30.1%).

Among women with a live birth since August 1, 2017, 67.4% reported receiving a provider offer of Tdap, 11.9% received a recommendation but no offer, and 20.7% received no recommendation (Table). The percentages of these women who received Tdap among these groups were 73.5%, 38.3%, and 1.6%, respectively. Among women who reported that their provider recommended but did not offer Tdap, 52.9% received a referral.¶ Among women who received a referral, 56.1% received Tdap, compared with 18.5% of women who received a provider recommendation but did not receive a referral.

¶ Referral is defined based on a "yes" response to the question "Did any doctor, nurse, or medical professional suggest that you go someplace else to get the <flu/Tdap> vaccination?"

TABLE. (*Continued*) Influenza and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccination (Tdap) coverage among pregnant women, by selected characteristics — Internet panel survey, United States, April 2018

Abbreviation: N/A = not applicable.

* Women pregnant any time during October–January were included in the analysis to assess influenza vaccination coverage for the 2017–18 season. Women who received an influenza vaccination since July 1, 2017, before or during their pregnancy were considered vaccinated.

† Women pregnant any time since August 1, 2017, and had a live birth were included in the analysis to assess Tdap coverage. Women who received a Tdap vaccination during their recent pregnancy were considered vaccinated.

§ ≥5 percentage-point difference compared with reference group.

¶ Reference group for comparison within subgroups.

** Race/ethnicity was self-reported. Women identified as Hispanic might be of any race. Women categorized as white, black, or other race were identified as non-Hispanic. The "other" race category included Asians, American Indians or Alaska Natives, Native Hawaiians or other Pacific Islanders, and women who selected "other" or multiple races.

†† Women considered to have any public insurance selected at least one of the following when asked what kind of medical insurance they had: Medicaid, Medicare, Indian Health Service, state sponsored medical plan, or other government plan. Women considered to have private/military insurance selected private medical insurance and/or military medical insurance and did not select any type of public insurance.

§§ Estimates not reported because sample size was <30.

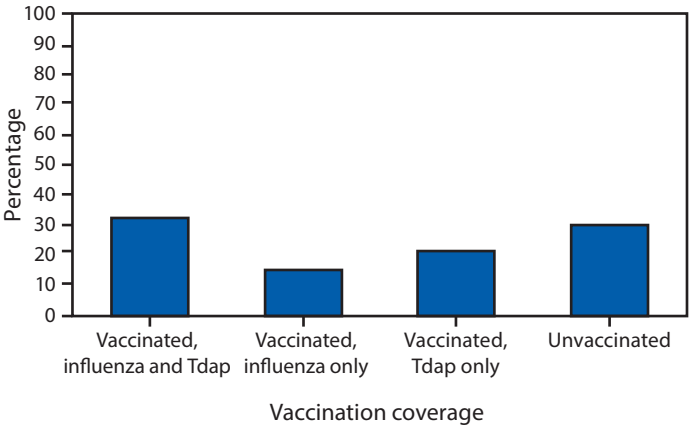
¶¶ Women who were employed for wages and self-employed were categorized as working; those who were out of work, homemakers, students, retired, or unable to work were categorized as not working.

*** Poverty status was defined based on the reported number of people and children living in the household and annual household income, according to the U.S. Census poverty thresholds (https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html).

††† Conditions associated with increased risk for serious medical complication from influenza, including chronic asthma, a lung condition other than asthma, a heart condition, diabetes, a kidney condition, a liver condition, obesity, or a weakened immune system caused by a chronic illness or by medicines taken for a chronic illness. Women who were missing information were not included in the analysis for high-risk conditions (n = 233).

§§§ Excluded women who did not report having a provider visit since July 2017 (n = 30) for the influenza vaccination coverage analysis; no women were excluded for the Tdap vaccination coverage analysis.

FIGURE 1. Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) and influenza vaccination coverage* among women with a recent live birth — Internet panel survey, United States, April 2018



* Weighted percentage of women who reported 1) receiving influenza vaccine before or during pregnancy since July 1, 2017, and receiving Tdap vaccine during most recent pregnancy; 2) receiving influenza vaccine before or during pregnancy since July 1, 2017, but not receiving Tdap vaccine during most recent pregnancy; 3) receiving Tdap vaccine during most recent pregnancy but not receiving influenza vaccine before or during pregnancy since July 1, 2017; or 4) not receiving influenza vaccine before or during pregnancy since July 1, 2017, and not receiving Tdap vaccine during most recent pregnancy.

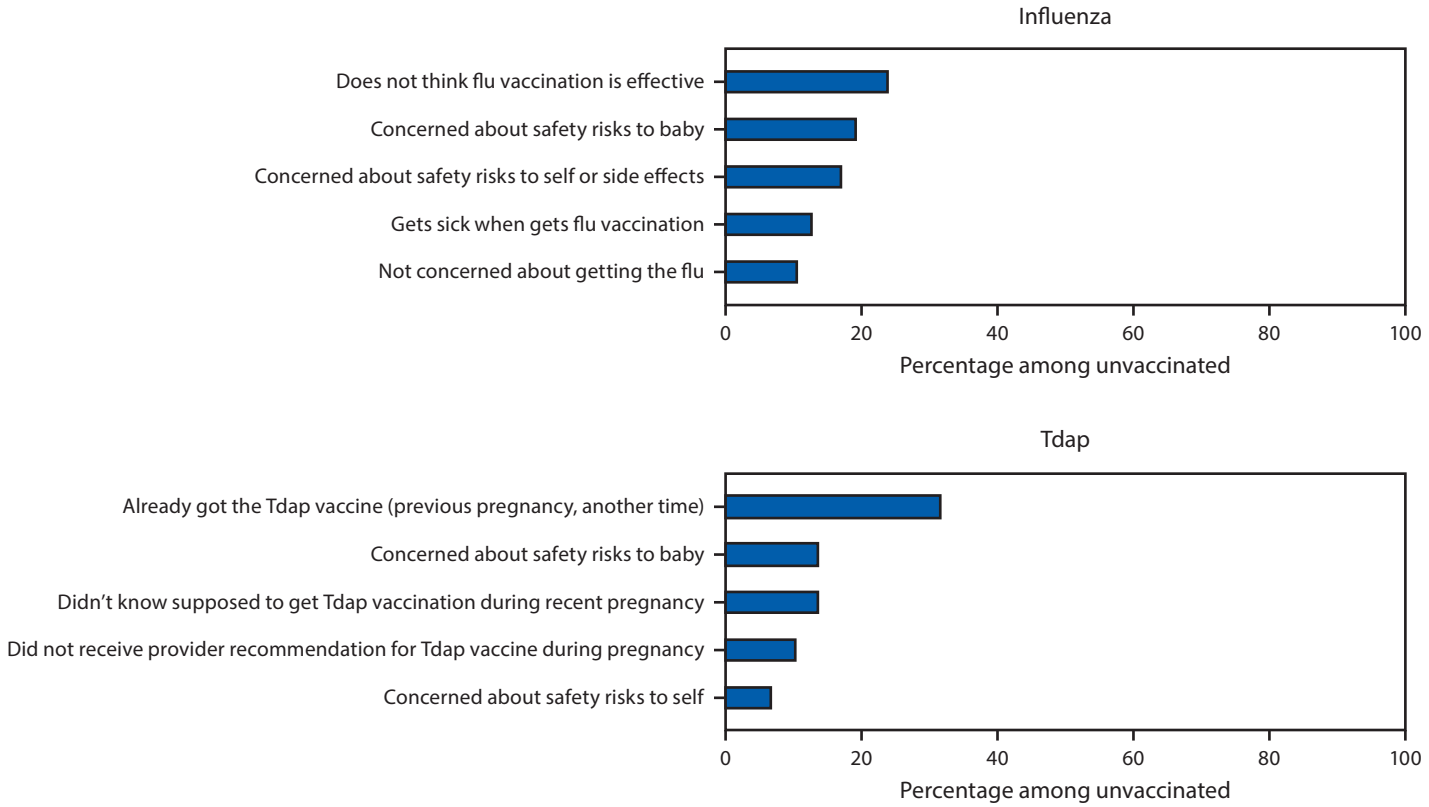
The most commonly reported main reason for not receiving influenza vaccination before or during pregnancy was belief that the vaccine is not effective (20.2%) (Figure 2). The most common main reason for not receiving Tdap during pregnancy was a lack of knowledge about the need to be vaccinated during every pregnancy (45.1%): 31.6% of women who did not receive vaccine during pregnancy reported having been vaccinated previously, and 13.5% reported not knowing they were supposed to receive Tdap during their recent pregnancy. The second most commonly reported main reason for nonreceipt of both vaccines was concern about safety risks to the baby (16.0% and 13.5% of women who did not receive influenza vaccine or Tdap, respectively).

Discussion

Findings from this survey indicate that many pregnant women are unvaccinated, and they and their babies continue to be vulnerable to influenza and pertussis infection and potentially serious complications including hospitalization and death. Providers are encouraged to strongly recommend vaccines that their patients need and either administer needed vaccines or refer patients to a vaccination provider (*5*). Vaccination coverage, regardless of vaccine type, was highest among pregnant women with a provider offer of vaccination, which has been reported previously (*4*,*6*). For providers unable to offer vaccination, referring patients to a vaccination provider was also shown to help improve vaccination coverage, especially for Tdap.

Missed opportunities to vaccinate were common, even among women with multiple health care visits. Many pregnant women reported not receiving a provider recommendation for vaccination, which might be partly attributable to differences in perception of a provider recommendation between patients and providers. Results from a survey of obstetric care providers conducted by the American College of Obstetricians and Gynecologists (ACOG) suggest that whereas providers believe they are giving a recommendation for vaccination, the recommendation might not be strong enough to be remembered by

FIGURE 2. Main reasons for not receiving influenza vaccine* or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap)† among pregnant women who did not receive influenza vaccine (n = 817) or Tdap (n = 297) — Internet panel survey, United States, April 2018



* Main reason for not receiving influenza vaccination among women pregnant any time during October–January in the 2017–18 influenza season who were not vaccinated as of early April 2018 (n = 817). Excluded women who were not vaccinated but did not provide information on the reason for not being vaccinated (n = 1).
† Main reason for not receiving Tdap among women who were recently pregnant at the time of the survey (March 28–April 10, 2018), had a live birth, and were not vaccinated during their most recent pregnancy (n = 297). Excluded women who were not vaccinated but did not provide information on the reason for not being vaccinated (n = 7).

patients (*7*). CDC has resources to assist providers in effectively communicating the importance of vaccination, such as sharing specific reasons why the recommended vaccine is right for the patient and highlighting positive experiences with vaccines (personal or practice).** Another available resource is the ACOG immunization toolkit which includes communication strategies for providers.†† The toolkit also includes extensive information on vaccine financing and coding that could address perceived financial barriers, a commonly reported barrier to stocking vaccine (*8*).

Examination of reasons for nonvaccination provides insight into why some women received influenza vaccination or Tdap, but not both, and further highlights the importance of an effective provider recommendation for vaccination. Provider awareness of concern about effectiveness of the influenza vaccine, lack of knowledge about the recommendation to receive Tdap during every pregnancy, and concern about safety risks to the baby related to both vaccines can help providers address these issues with their patients through education and thus strengthen their recommendations for vaccination.

The findings in this report are subject to at least four limitations of the survey, three of which have been reported previously (*3*,*4*). First, this was a nonprobability sample, and results might not be generalizable to all pregnant women in the United States. Second, vaccination status was self-reported and might be subject to recall bias or social desirability bias. Third, the Tdap coverage estimates might be subject to uncertainty, given the exclusion of 14.1% of women with unknown Tdap vaccination status from estimations of Tdap coverage. Finally, although Internet panel surveys of pregnant women have been conducted since the 2010–11 influenza season, a methodology change increased the proportion of women who were able to complete the 2018 survey on a smartphone or other handheld device and limits the ability to make comparisons to estimates

** https://www.acog.org/-/media/Departments/Immunization/ImmunizationToolkit.pdf.
†† https://www.cdc.gov/vaccines/hcp/adults/for-practice/standards/recommend.html.

Summary

What is already known about this topic?

Vaccinating pregnant women with influenza and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccines can reduce the risk for severe complications from influenza and pertussis for themselves and their infants.

What is added by this report?

During the 2017–18 influenza season, 49.1% of pregnant women received influenza vaccination before or during pregnancy, 54.4% of women with a live birth received Tdap during pregnancy, and 32.8% received both recommended vaccines.

What are the implications for public health practice?

Implementing the Standards for Adult Immunization Practice to assess pregnant women's vaccination status, provide an effective vaccination recommendation, administer vaccines or refer to a vaccination provider for vaccination, and document vaccines administered by providers can help ensure pregnant women are fully vaccinated.

from previous seasons; however, both influenza vaccination and Tdap coverage estimates were similar to those reported from the April 2017 survey (*4*,*6*). Despite these limitations, Internet panel surveys are considered a useful assessment tool for timely evaluation of influenza vaccination and Tdap coverage among pregnant women.

Despite ACIP recommendations, maternal vaccination with influenza and Tdap vaccines is suboptimal, and missed opportunities to vaccinate are common. Findings in this report reinforced the importance of a provider's recommendation and offer of vaccination, or referral, to pregnant patients in receipt of recommended vaccination. Vaccination coverage of pregnant women can be increased by implementation of evidence-based practices, as indicated by the Standards for Adult Immunization Practices, such as screening patients for recommended vaccinations at every opportunity, reminders to notify providers that their patients need vaccinations, and patient education about ACIP vaccination recommendations and safety and benefits of maternal vaccination (*5*,*9*,*10*).

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Meningococcal Disease Surveillance in Men Who Have Sex with Men — United States, 2015–2016

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Meningococcal disease is a rare, but serious, bacterial infection that progresses rapidly and can be life-threatening, even with prompt antibiotic treatment. Men who have sex with men (MSM) have previously been reported to be at increased risk for meningococcal disease compared with other men, and recent outbreaks of serogroup C meningococcal disease among MSM have occurred (*1*). However, the epidemiology of meningococcal disease among MSM in the United States is not well described, in part, because information about MSM has not historically been collected as part of routine meningococcal disease surveillance. To better characterize and identify risk factors for meningococcal disease in general, supplementary data and isolates have been collected since 2015 through enhanced meningococcal disease surveillance activities. During 2015–2016, 271 cases of meningococcal disease in men aged ≥18 years were reported to the National Notifiable Diseases Surveillance System (NNDSS) in 45 states participating in this enhanced surveillance. Forty-eight (17.7%) cases were in men identified as MSM, including 17 (37.8%) with human immunodeficiency virus (HIV) infection. Among MSM, 39 (84.8%) cases were caused by *Neisseria meningitidis* serogroup C, whereas this serogroup was responsible for only 16.4% of cases among men who were not known to be MSM (non-MSM). Despite improvements in surveillance, MSM likely remain underascertained among men with meningococcal disease. Improved surveillance data are needed to understand the prevalence of and risk for meningococcal disease among MSM and inform policy and prevention strategies. Vaccination with quadrivalent meningococcal conjugate (MenACWY) vaccine is recommended for the control of meningococcal disease outbreaks caused by serogroups A, C, W, or Y, including during outbreaks among MSM; in addition, all persons aged ≥2 months with HIV infection should receive MenACWY vaccine because of the increased risk for meningococcal disease.

Since 2003, seven outbreaks (*2*) of serogroup C meningococcal disease have been reported among MSM in four metropolitan areas in the United States (Chicago, Los Angeles County/Southern California, Miami, and New York City) (*1*,*3*). An analysis of cases reported in NNDSS during January 2012–June 2015 demonstrated that the risk for meningococcal disease among MSM (0.56 cases per 100,000 population) was four times that among other men (0.14) (*1*). Whereas HIV infection appeared to be associated with the increased risk for sporadic illness observed in that study, additional risk factors for meningococcal disease, including in outbreak-associated cases, have not been well established. The prevalence and epidemiology of meningococcal disease in this population remain poorly described because information to identify MSM and HIV infection was not routinely collected before 2015.

In 2015, enhanced meningococcal disease surveillance activities were implemented in 45 U.S. states as part of the Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement to routinely collect isolates and supplementary data (including information to identify MSM and HIV infection) on meningococcal disease cases reported to NNDSS. To assess completeness of this information and report updated findings on MSM with meningococcal disease, all confirmed and probable meningococcal disease cases among men aged ≥18 years reported to NNDSS by enhanced meningococcal disease surveillance–participating states during January 2015–December 2016 were reviewed. State or local health departments classified cases as occurring in either MSM or non-MSM; the latter group included men for whom information to identify MSM was missing. During this 2-year period, 39 state health departments identified MSM by asking adult male patients about either their sexual orientation or gender of their main sex partner or both or by obtaining this information from other sources (e.g., medical record); six states did not collect this information. States also classified cases as occurring in men with and without HIV infection, as well as being outbreak-associated or sporadic. A case report form to collect additional data on potential risk factors was completed for cases occurring in MSM. Serogroup was determined by polymerase chain reaction and slide agglutination. Sequence type (ST) was determined using whole genome sequencing. Incidence was calculated as the number of meningococcal disease cases per 100,000 men aged ≥18 years. Population denominators for non-MSM (*4*) and MSM (*5*) were derived from the 2016 American Community Survey. HIV prevalence among MSM was estimated from the 2014 National HIV Behavioral Surveillance Report (*6*).

During 2015–2016, a total of 271 cases of meningococcal disease in men aged ≥18 years were reported. Among these, sufficient information to identify MSM was available for 124 (45.8%). Overall, 48 (17.7%) cases occurred in MSM (Table 1). Information on HIV status was available for 133 (49.1%) cases, although completeness of this information

TABLE 1. Characteristics of meningococcal disease cases among men aged ≥18 years, by MSM status — United States, 2015–2016

	MSM (n = 48)		Non-MSM* (n = 223)	
Characteristic	**No. (%)†**	**% Completeness§**	**No. (%)†**	**% Completeness§**
Age group (yrs)				
18–24	6 (12.5)	100.0	50 (22.4)	100.0
25–29	12 (25.0)		20 (9.0)	
30–39	15 (31.3)		36 (16.1)	
40–49	6 (12.5)		26 (11.7)	
50–64	6 (12.5)		63 (28.3)	
≥65	3 (6.3)		28 (12.6)	
Total	**48**		**223**	
Race				
White	30 (66.7)	93.8	129 (68.3)	84.8
Black	13 (28.9)		53 (28.0)	
Other¶	2 (4.4)		7 (3.7)	
Total	**45**		**189**	
Ethnicity				
Hispanic	10 (22.2)	93.8	34 (18.3)	83.4
Non-Hispanic	35 (77.8)		152 (81.7)	
Total	**45**		**186**	
HIV infection status				
Infected	17 (37.8)	93.8	0 (—)	39.5
Uninfected	28 (62.2)		88 (100.0)	
Total	**45**		**88**	
Associated with MD outbreak				
Yes	32 (66.7)	100.0	18 (8.1)	100.0
No	16 (33.3)		205 (91.9)	
Total	**48**		**223**	
Outcome				
Survived	42 (87.5)	100.0	173 (85.2)	91.0
Died	6 (12.5)		30 (14.8)	
Total	**48**		**203**	
Serogroup				
B	4 (8.7)	**95.8**	81 (40.3)	**90.1**
C	39 (84.8)		33 (16.4)	
W	1 (2.2)		26 (12.9)	
Y	1 (2.2)		38 (18.9)	
Nongroupable	1 (2.2)		22 (10.9)	
Total	**46**		**201**	

Abbreviations: HIV = human immunodeficiency virus; MD = meningococcal disease; MSM = men who have sex with men.
* Includes 76 men known to be non-MSM and 147 men with missing MSM information.
† Calculated among those with a known response.
§ Number of known responses divided by the total number of responses.
¶ Including Asian and other race.

was higher among MSM (45 of 48; 93.8%) than among non-MSM (89 of 223; 39.5%). Among the 133 men with known HIV status, 17 (12.8%) had HIV infection, all of whom were MSM, accounting for 37.8% of 45 MSM with known HIV status. Among cases in MSM, the median age was 32 years, 66.7% of patients were white, and 77.8% were non-Hispanic. In contrast, among 223 cases in non-MSM, the median age was 41 years, 68.3% were white, and 81.7% were non-Hispanic. All cases in MSM were reported from 12 states. Thirty-two (66.7%) cases in MSM were associated with three outbreaks, which were reported through enhanced surveillance activities: 11 cases in the Chicago outbreak, 20 cases in the Southern California outbreak, and one case in Miami (four additional outbreak-associated cases were reported in 2017). Six (12.5%) additional cases were reported from jurisdictions that had previously reported an outbreak of meningococcal disease. In contrast, 18 (8.1%) cases in non-MSM were associated with an outbreak of meningococcal disease. *N. meningitidis* serogroup C accounted for 39 (84.8%) cases in MSM, compared with 16.4% of cases in non-MSM (Table 1). Among cases of serogroup C meningococcal disease in MSM with available molecular data, all were caused by ST-11 strains, although the meningococci had five different molecular profiles, as defined by the combination of ST, FetA, PorA, and PorB types. The outbreaks in Chicago and Southern California involved meningococci with different molecular profiles, and thus were distinct from each other. Among MSM, six of 48 (12.5%) cases were fatal, whereas 30 of the 203 (14.8%) cases in non-MSM were fatal. The case-fatality ratio was not statistically significantly different in MSM with and without HIV infection (11.8% and 14.3%, respectively). Among cases in MSM, HIV infection status and case-fatality ratios were not statistically significantly different among outbreak-associated cases (35.5% and 12.5%, respectively) and sporadic cases (42.9% and 12.5% respectively).

The incidence of meningococcal disease among MSM was 0.54 cases per 100,000 population (Table 2). The incidence of meningococcal disease among MSM in jurisdictions that reported an outbreak of meningococcal disease among MSM was 3.27 cases per 100,000 population, which was higher than the rate in jurisdictions that did not report an outbreak of meningococcal disease (0.19 cases per 100,000). The incidence of reported cases among non-MSM men was 0.10 per 100,000.

Discussion

Meningococcal disease incidence has been decreasing in all age groups in the United States since 1996 (*7*), although outbreaks continue to occur. The results of this analysis, using data collected through enhanced meningococcal disease surveillance activities, are consistent with a previous report (*1*) demonstrating that the increased incidence of reported meningococcal disease among MSM is largely driven by outbreaks. In the nonoutbreak setting, HIV appears to be a likely risk factor for disease; the incidence of sporadic meningococcal disease was higher in HIV-infected MSM compared to HIV-uninfected MSM. The role of other potential risk factors remains unclear, highlighting the need to strengthen surveillance and collect additional data.

Identifying MSM among meningococcal disease patients and improving collection of data on HIV status will be important to better understand the epidemiology and risk factors for transmission and disease among MSM and to guide meningococcal

TABLE 2. Incidence of reported meningococcal disease among men who have sex with men (MSM) and men not known to be MSM (non-MSM) aged ≥18 years — United States, 2015–2016

Category	No. of cases	Estimated population	Incidence (per 100,000)
Non-MSM, all	223	224,572,168	0.10
MSM, all	48	8,879,801	0.54
MSM, outbreak*	32	979,522	3.27
HIV-infected†	11	202,761	5.43
HIV-uninfected†	20	776,761	2.57
MSM, sporadic§	15	7,900,279	0.19
HIV-infected¶	5	1,706,460	0.29
HIV-uninfected¶	8	6,193,819	0.13

Abbreviation: HIV = human immunodeficiency virus.
* Cases reported in jurisdictions that reported a cluster or outbreak of meningococcal disease among MSM; denominator was estimated from the population in the counties within these jurisdictions.
† HIV status was available for 31 of 32 cases.
§ Cases reported in jurisdictions that did not report a cluster or outbreak of meningococcal disease among MSM; denominator was estimated from the population in the counties within these jurisdictions.
¶ HIV status was available for 13 of 15 cases.

vaccination policy and other prevention strategies. Because persons with HIV infection have an increased risk for meningococcal disease, the Advisory Committee on Immunization Practices recommends that persons aged ≥2 months with HIV infection receive MenACWY vaccine (*8*); currently, no recommendation exists for routine vaccination with meningococcal conjugate vaccine for all MSM.

The findings in this report are subject to at least two limitations. First, half of meningococcal disease cases among adult men did not have information allowing identification of MSM, and thus were presumed to have occurred among non-MSM for this analysis, reflecting the likely underascertainment and potential misclassification of some cases among MSM as cases among non-MSM. However, no standard surveillance definition for MSM currently exists, despite MSM being at increased risk for other infectious diseases (*9*). In addition, because 79% of cases in MSM were identified in jurisdictions that had ever reported an outbreak of meningococcal disease, it is unclear whether this high proportion reflects the actual epidemiology in this population or whether ascertainment is better in these jurisdictions as a consequence of heightened awareness because of past outbreaks. Second, whereas completeness of data on HIV status was high among cases in MSM, improved completeness of HIV status among men who were not known to be MSM is important for understanding the role of HIV infection in the risk for meningococcal disease among MSM and the general population. A higher proportion of cases in MSM had HIV infection, although the low completeness of data on HIV status of cases among non-MSM men limits the ability to accurately describe the proportion with HIV infection.

Summary

What is already known about this topic?

Men who have sex with men (MSM) have been reported to be at increased risk for meningococcal disease in the United States. The epidemiology of disease in this group is not well described because information on MSM historically has not been collected through routine meningococcal disease surveillance.

What is added by this report?

Enhanced surveillance demonstrates that MSM, including those with human immunodeficiency virus (HIV) infection, have an increased meningococcal disease incidence compared with that in non-MSM.

What are the implications for public health practice?

Identifying MSM among meningococcal disease patients and improving collection of data on HIV status for all cases are important to understanding the epidemiology and risk factors for meningococcal disease among MSM.

Although enhanced meningococcal disease surveillance fills an important gap in meningococcal disease surveillance, the limitations of this analysis reflect areas for strengthening surveillance. In addition, vaccination with MenACWY vaccine is recommended for the control of meningococcal disease outbreaks due to serogroups A, C, W, or Y, including during outbreaks among MSM; in addition, all persons aged ≥2 months with HIV infection should receive MenACWY vaccine because of the increased risk of meningococcal disease (*8*). During investigations of meningococcal disease caused by any serogroup, state and local health departments are encouraged to assess HIV status of all patients and identify MSM among male patients aged ≥16 years.* All state health departments are asked to submit any available isolates to CDC for whole genome sequencing.

* As part of enhanced surveillance activities, state and local health departments are encouraged to identify MSM among male patients aged ≥16 years. The analysis was restricted to those aged ≥18 years to be consistent with previous analyses and to calculate incidence using available denominator data.

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Multidrug-Resistant *Aspergillus fumigatus* Carrying Mutations Linked to Environmental Fungicide Exposure — Three States, 2010–2017

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The environmental mold *Aspergillus fumigatus* is the primary cause of invasive aspergillosis. In patients with high-risk conditions, including stem cell and organ transplant recipients, mortality exceeds 50%. Triazole antifungals have greatly improved survival (*1*); however, triazole-resistant *A. fumigatus* infections are increasingly reported worldwide and are associated with increased treatment failure and mortality (*2*). Of particular concern are resistant *A. fumigatus* isolates carrying either TR_{34}/L98H or TR_{46}/Y121F/T289A genetic resistance markers, which have been associated with environmental triazole fungicide use rather than previous patient exposure to antifungals (*3*,*4*). Reports of these triazole-resistant *A. fumigatus* strains have become common in Europe (*2*,*3*), but U.S. reports are limited (*5*). Because of the risk posed to immunocompromised patients, understanding the prevalence of such isolates in patients is important to guide clinical and public health decision-making. In 2011, CDC initiated passive laboratory monitoring for U.S. triazole-resistant *A. fumigatus* isolates through outreach to clinical laboratories. This system identified five TR_{34}/L98H isolates collected from 2016 to 2017 (*6*), in addition to two other U.S. isolates collected in 2010 and 2014 and reported in 2015 (*5*). Four of these seven isolates were reported from Pennsylvania, two from Virginia, and one from California. Three isolates were collected from patients with invasive pulmonary aspergillosis, and four patients had no known previous triazole exposure. *A. fumigatus* resistant to all triazole medications is emerging in the United States, and clinicians and public health personnel need to be aware that resistant infections are possible even in patients not previously exposed to these medications.

Triazole antifungal medications are the primary treatment for invasive *A. fumigatus* infections, opportunistic infections that typically affect immunocompromised patients. Invasive aspergillosis is almost universally fatal without antifungal treatment. Clinical outcomes improved with the use of amphotericin B and have improved further with the introduction of mold-active triazole antifungals such as voriconazole, posaconazole, and itraconazole, which are also associated with fewer adverse events than is amphotericin B (*7*). Resistance to triazoles has been associated with treatment failure and increased mortality, but the prevalence of infection with resistant strains in U.S. hospitals is unknown (*1*,*4*). Structurally similar triazoles are used extensively as fungicides in agriculture and other environmental applications. *A. fumigatus* is not typically a plant pathogen but is common in soil and decaying plant material. Incidental exposure of *A. fumigatus* to fungicides during agricultural or other environmental applications can select for mutations conferring resistance to triazoles. *A. fumigatus* spores are known to be carried long distances in the air, putting patients at risk for infection with resistant strains, even in areas without known agricultural fungicide usage.

In Europe, molecular epidemiologic studies have identified two resistant *A. fumigatus* genotypes associated with environmental triazole exposure (*4*). These genotypes, TR_{34}/L98H and TR_{46}/Y121F/T289A, confer resistance to triazoles by altering the drug target, Cyp51A, which is involved in fungal cell wall synthesis. Importantly, TR_{34}/L98H confers resistance to all mold-active medical triazoles without incurring a fitness cost or survival disadvantage to the fungus. *A. fumigatus* strains of this genotype have been isolated from the environment (e.g., compost, seeds, soil, commercial plant bulbs, and patient households) (*8*). Although these mutations have been detected repeatedly in environmental isolates, they have not been common among isolates from patients treated with long-term triazoles in whom resistance might have been expected to develop. Most (50%–75%) patients with TR_{34}/L98H isolates have not been exposed to triazole therapy, further suggesting environmental acquisition of resistance (*3*).

Until 2015, no isolates with these genotypes had been reported in the United States; that year, a U.S. fungal reference laboratory reported detecting two TR_{34}/L98H and two TR_{46}/Y121F/T289A *A. fumigatus* isolates among 220 clinical isolates collected from 2001 to 2014 (*5*). In 2017, TR_{34}/L98H *A. fumigatus* isolates were first detected in U.S. environmental samples obtained from a commercial peanut field treated with triazole fungicides (*9*). Together, these reports demonstrate that triazole-resistant *A. fumigatus* strains have emerged in the United States in both patients and the environment, likely caused by selection for resistance during environmental triazole use.

In 2011, CDC issued a request for clinical *A. fumigatus* isolates on the ClinMicroNet e-mail listserv of approximately 800 U.S. clinical microbiology laboratory directors, leading to a U.S. laboratory-based convenience sample of *A. fumigatus* isolates (systematic public health surveillance for *A. fumigatus* has not been conducted in the United States). In 2016, CDC

received the first TR_{34}/L98H isolate through this passive monitoring system, and an additional four have been identified to date among approximately 2,300 total isolates received (*6*). Together, these five and the two previously reported isolates (*5*) represent the first seven TR_{34}/L98H isolates identified in the United States (Table). This report provides epidemiologic and clinical descriptions of the patients associated with these *A. fumigatus* triazole-resistant isolates.

Clinical Summaries

Pennsylvania, 2010. Following stem cell transplantation for sickle cell anemia, a woman developed graft-versus-host disease and respiratory failure. Resistant *A. fumigatus* was isolated from sputum. Despite therapy with voriconazole and caspofungin, her respiratory status worsened, and therapy was switched to amphotericin B and caspofungin. She deteriorated further and died of multisystem organ failure 6 months after isolate collection.

Pennsylvania, 2014. A man with *A. fumigatus* colonization following lung transplantation initially was treated with long-term voriconazole followed by itraconazole. He was hospitalized with bacterial and viral pneumonia, developed clinical invasive pulmonary aspergillosis, and was treated with itraconazole and caspofungin, followed by posaconazole and caspofungin, then inhaled amphotericin B. Resistant *A. fumigatus* was isolated from a bronchoalveolar lavage. With worsening clinical status and persistently positive *A. fumigatus* cultures, therapy was switched to liposomal amphotericin B and caspofungin; however, bronchoscopy indicated ongoing fungal infection. He died from multisystem organ failure approximately 2 months after isolate collection.

Pennsylvania, 2016. A woman with sarcoidosis and invasive pulmonary aspergillosis was treated with low-dose voriconazole because of vision-associated side effects at higher doses. Respiratory symptoms had worsened at the time of sputum collection, and when the resistant *A. fumigatus* isolate was identified, therapy was changed to caspofungin for 12 months. Following therapy, the patient was clinically stable with no radiographic evidence of progression to chronic cavitary pulmonary aspergillosis or aspergilloma.

Pennsylvania, 2017. A resistant *A. fumigatus* isolate was collected by bronchoalveolar lavage from a woman with chronic obstructive pulmonary disease, interstitial pulmonary fibrosis, and hypersensitivity pneumonitis, while she was hospitalized for hydropneumothorax and bacterial pneumonia secondary to trauma; no antifungal treatment was given. The patient died of complications of her hydropneumothorax thought to be unrelated to *A. fumigatus*.

Virginia, 2016, case 1. A man who visited Virginia from Guatemala was hospitalized for acute bronchitis 3 weeks after his arrival. Resistant *A. fumigatus* was isolated from sputum during this hospitalization. No antifungals were administered, and the patient was discharged to primary care.

Virginia, 2016, case 2. A woman with cystic fibrosis had resistant *A. fumigatus* isolated from sputum at an outpatient visit 2 days before hospital admission for a cystic fibrosis exacerbation. While hospitalized, she received steroids and antibiotics but not antifungals. She was later discharged with oral antibiotics.

California 2017. A woman with a history of chronic obstructive pulmonary disease requiring inhaled corticosteroids, chronic heart failure, and chronic kidney disease was evaluated as an outpatient for a productive cough. Sputum cultures grew *A. fumigatus*, and IgG antibody to *A. fumigatus* was twice the normal value. She was not started on antibiotics or antifungals.

Discussion

A. fumigatus strains with mutations conferring resistance to mold-active triazole agents have been found in clinical and environmental specimens in the United States. In total, 10 U.S. clinical isolates with these genotypes (seven TR_{34}/L98H and three TR_{46}/Y121F/T289A) have been reported (*5*,*10*). Together, these reports likely underrepresent the number of U.S. isolates because aspergillosis and *A. fumigatus* colonization are not reportable in any state and few laboratories perform susceptibility testing for *Aspergillus* species. Four of the seven patients with TR_{34}/L98H were not treated with antifungal therapy following culture; these four isolates, all from sputum or bronchoalveolar lavage, likely reflected *A. fumigatus* colonization rather than infection. However, the presence of highly resistant *A. fumigatus* strains in patient isolates suggests that U.S. clinicians need to be aware of the risk for triazole-resistant aspergillosis. Notably, four patients had no known exposure to antifungal medications before culture of the resistant isolate, supporting possible environmentally acquired resistance.

The five isolates identified at CDC during 2016–2017 were collected from patients who did not share health care facilities, procedures, or county of residence, arguing against shared health care acquisition. Given that *A. fumigatus* can undergo selection for antifungal resistance during triazole fungicide exposure in the environment, and spores of resistant strains might be transmitted through the air and inhaled, further exploration of triazole fungicide use and presence of triazole-resistant *A. fumigatus* in these areas is warranted.

The findings in this report are subject to at least two limitations. First, among the seven *A. fumigatus* isolates with the TR_{34}/L98H mutations identified in the United States to date, four were collected in Pennsylvania, two in Virginia, and one in California. These three states contributed only 28% of all

TABLE. Characteristics of seven patients from whom TR_{34}/L98H triazole-resistant *Aspergillus fumigatus* was isolated — California, Pennsylvania, and Virginia, 2010–2017

State of origin	Collection year	Source	Cyp51 genotype	Age range (yrs)	Sex	Underlying disease	Known previous triazole exposure?	Previous triazole exposure description	Colonization versus infection (suspected)*	Antifungal treatment	Outcome
Pennsylvania†	2010	Sputum	TR_{34}/L98H	20–29	F	Respiratory failure following stem cell transplant	Yes	VRC; dose and duration unknown	Infection	VRC and CAS; L-AmB and CAS	Died
Pennsylvania†	2014	BAL	TR_{34}/L98H	40–49	M	*A. fumigatus* colonization following lung transplant that progressed to multifactorial pneumonia and clinical IPA	Yes	VRC, ITC; dose and duration unknown	Infection	ITC and CAS; POS and CAS; L-AmB and CAS	Died
Pennsylvania	2016	Sputum	TR_{34}/L98H	60–69	F	Chronic IPA, sarcoidosis	Yes	VRC 200 mg/day; duration unknown	Infection	VRC; CAS	Alive at discharge
Pennsylvania	2017	BAL	TR_{34}/L98H	80–89	F	Hydropneumothorax with history of COPD and pulmonary fibrosis	No	Inpatient hospitalization, primary care, pulmonologist and pharmacy records indicate no record of triazole or other antifungal prescriptions	Colonization	None	Died
Virginia (nonresident)	2016	Sputum	TR_{34}/L98H	70–79	M	Acute bronchitis and lung nodules; no history of immunocompromise	No	No triazole history available or suspected before hospitalization in Virginia; patient resides in Guatemala	Colonization	None	Alive at discharge
Virginia	2016	Sputum	TR_{34}/L98H	20–29	F	Cystic fibrosis	No	None reported in 6 months preceding isolate collection	Colonization	None	Alive at discharge
California	2017	Sputum	TR_{34}/L98H	80–89	F	COPD, chronic heart failure, and chronic kidney disease	No	No triazole history available or suspected before hospitalization	Colonization	None	Alive at discharge

Abbreviations: BAL = bronchoalveolar lavage; CAS = caspofungin; COPD = chronic obstructive pulmonary disease; F = female; IPA = invasive pulmonary aspergillosis; ITC = itraconazole; L-AmB = liposomal amphotericin B; M = male; POS = posaconazole; VRC = voriconazole.

* Colonization versus infection indicated based on explicit description in patient medical record or by treating physician, or, if not explicitly stated, suspicion based on public health review of record.

† Wiederhold NP, Gil VG, Gutierrez F, et al. First detection of TR_{34} L98H and TR_{46} Y121F T289A Cyp51 mutations in *Aspergillus fumigatus* isolates in the United States. J Clin Microbiol 2016;54:168–71..

CDC *A. fumigatus* isolates collected during 2015–2017, raising the possibility of geographic localization. Second, because isolates were collected through passive monitoring and not systematic surveillance, caution must be exercised when interpreting these findings.

With environmentally derived TR_{34}/L98H triazole-resistant *A. fumigatus* detected in the United States, systematic surveillance, detailed geographic data, and data on triazole fungicide use could be important for assessing the scope of the problem and trends in resistance. Exploration of risk factors for patient acquisition might provide opportunities to prevent exposure and mitigate risk for invasive infection in susceptible populations. Clinicians and microbiologists need to be aware of the possibility of triazole-resistant *A. fumigatus* infections,

Summary

What is already known about this topic?

The environmental mold *Aspergillus fumigatus* is the primary cause of invasive aspergillosis. In patients with high-risk conditions, mortality exceeds 50%. *A. fumigatus* isolates resistant to medical triazoles have recently been identified in the United States in clinical and environmental specimens. The resistance marker TR_{34}/L98H causes resistance to all triazoles and is associated with agricultural and environmental fungicide use.

What is added by this report?

Seven U.S. clinical TR_{34}/L98H *A. fumigatus* isolates were identified during 2010–2017 from three states; four were collected from patients with no known previous triazole exposure.

What are the implications for public health practice?

U.S. clinicians and public health personnel should be aware that infections with triazole-resistant *A. fumigatus* can occur in patients not previously exposed to these medications.

even in triazole-naïve patients. Expanded capacity to test for antifungal susceptibility in *A. fumigatus* could help inform clinical and public health decisions.

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Barriers to Receipt of Prenatal Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccine Among Mothers of Infants Aged <4 Months with Pertussis — California, 2016

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Vaccination with tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine is recommended for all pregnant women to protect infants who are too young for vaccination from severe pertussis-related outcomes (*1*–*3*). However, Tdap vaccine coverage among pregnant women remains suboptimal in California (*4*). California mothers whose infants developed pertussis in 2016 and their prenatal care providers were interviewed to ascertain possible reasons for low Tdap vaccine coverage. Mothers who were offered Tdap vaccination on-site during a routine prenatal visit were more likely to be vaccinated than were mothers who were referred off-site for vaccination. Mothers insured by Medicaid were less likely to receive Tdap vaccine than were mothers with private insurance, even when the vaccine was stocked on-site. Nearly all vaccinated mothers received Tdap vaccine in their prenatal clinic. Incorporating Tdap vaccination into routine prenatal care visits is an effective means to increase prenatal Tdap vaccination coverage.

Most severe and fatal cases of pertussis occur in infants who have not yet started the primary pertussis vaccination series. To reduce the incidence of pertussis in these young infants, the Advisory Committee on Immunization Practices (ACIP) recommends that pregnant women receive Tdap vaccine at the earliest opportunity, during 27–36 weeks' gestation of each pregnancy (*3*). Vaccination during this period results in optimal transplacental transfer of maternal pertussis antibodies, which provides infants with passive protection against pertussis during the first weeks of life (*1*–*3*). Despite this recommendation, prenatal Tdap vaccine coverage in California remains low, with 52% of pregnant women estimated to have been vaccinated, and coverage is even lower (40%) among women with Medicaid insurance (*5*). In 2016, a low-incidence pertussis year in California, 114 pertussis cases, which included two pertussis-related deaths, occurred among infants aged <4 months.

California local health department personnel completed a case report form and attempted to complete a supplemental questionnaire using information collected during routine case investigation interviews with mothers of all 114 infants aged <4 months with pertussis who had illness onset during 2016. Interviewed mothers were asked to identify their prenatal care provider; whether they received a recommendation for Tdap vaccination during pregnancy with the case infant; whether they received Tdap vaccine; and if so, the date and location it was administered. Mothers who reported that they did not receive Tdap vaccine during pregnancy were asked why Tdap vaccine was not administered. Prenatal care providers were asked to identify the mothers' insurance type during pregnancy; whether Tdap vaccination was recommended during pregnancy; whether Tdap vaccine was stocked in the clinic; and if not, why it was not stocked. Providers were also asked to verify the mothers' Tdap vaccination status, and if Tdap vaccine was administered, the date and gestational week of administration. If mothers were referred off-site for Tdap vaccination, providers were asked whether they followed up to ensure that Tdap vaccination occurred. In addition, the California Immunization Registry was searched in an attempt to identify doses of Tdap vaccine that were not reported during interviews. However, this registry was mandated in late 2016 for pharmacists only. Additional variables collected from infant pertussis case reports included whether the infant was hospitalized or admitted to an intensive care unit (ICU) and the infant's outcome. Relative risks and 95% confidence intervals (CIs) were calculated to identify differences between vaccinated and unvaccinated mothers and barriers to receipt of prenatal Tdap vaccine. Because reporting of pertussis cases in infants aged <4 months is mandated in California, the follow-up interviews and data collected for this analysis were considered to be nonresearch data.

Sixty-six (58%) mothers and their prenatal care providers completed the supplemental questionnaire during routine case investigations. Data on mother's insurance status, stocking status of Tdap vaccine by provider, or mother's gestational week of pregnancy (if vaccinated) were incomplete for six (9%) mothers and were excluded from relevant calculations. Twenty-six (39%) of the 66 interviewed mothers reported receiving Tdap vaccine during their pregnancy with the case infant; among these, 24 (92%) were vaccinated at their prenatal care provider's office. Prenatal care providers documented Tdap vaccine administration for 25 of the 26 mothers who reported vaccination; no information on a Tdap vaccine dose was found in the medical record or the California Immunization Registry for one mother. Among the 25 mothers with documentation

of receipt of prenatal Tdap vaccine, 20 (80%) were vaccinated according to ACIP recommendations, during 27–36 weeks' gestation (median = 32 weeks). Five (20%) mothers received Tdap vaccine outside the recommended 27–36 week time frame (one each at 26, 38, and 39 weeks' gestation and two at 37 weeks). Among the 20 infants whose mothers were vaccinated during the recommended time frame, four were hospitalized, but none required admission to an ICU. Among the five infants whose mothers were vaccinated outside the recommended time frame, two were hospitalized, including one who required ICU admission and subsequently died.

Among the 66 interviewed mothers, 40 (61%) did not receive Tdap vaccine during pregnancy and among these mothers, 20 (50%) of their infants were hospitalized, including eight (40%) who were admitted to an ICU, one of whom died. Among the 40 unvaccinated mothers, 10 (25%) did not receive a recommendation or referral off-site for vaccination from their prenatal care provider, nine (23%) were referred off-site for vaccination but did not receive Tdap vaccine, eight (20%) mothers reported refusing Tdap vaccine for personal reasons, seven (18%) were deferred for vaccination by their provider for a reason not considered by ACIP to be a contraindication (prior receipt of Tdap vaccine, minor illness, or current medication use), three (8%) did not receive prenatal care during 27–36 weeks' gestation, one (3%) reported a possible valid contraindication (adverse reaction to pertussis vaccination as a child), and no information was available for two (5%) women (*6*) (Table 1). Sixteen (40%) of the 40 mothers who were not vaccinated during pregnancy received Tdap vaccine postpartum (the recommended strategy before 2011).

Among the 60 (91%) mothers with complete information, 19 (73%) of 26 women with private insurance and 15 (44%) of 34 women insured by Medicaid received prenatal care from a provider who stocked Tdap vaccine on-site (Table 2). Fourteen (54%) mothers with private insurance received Tdap vaccine on time, compared with six (18%) of mothers with Medicaid insurance. Mothers whose providers stocked Tdap vaccine on-site were significantly more likely to have been vaccinated (relative risk [RR] = 3.3; 95% CI = 1.9–5.5) than were mothers whose providers did not stock Tdap vaccine. Mothers insured by Medicaid were significantly less likely than those with private insurance to receive prenatal Tdap vaccine (0.4; 0.2–0.8) or to receive prenatal Tdap vaccine during the appropriate time frame, even when it was stocked on-site (0.5; 0.3–1.1).

Among the 61 interviewed prenatal care providers whose Tdap vaccine stocking policies were known, 34 (56%) stocked Tdap vaccine on-site. Among the 27 (44%) providers who did not stock Tdap vaccine on-site, 17 (63%) recommended Tdap vaccine during pregnancy, 16 of whom referred mothers off-site for vaccination, typically to a pharmacy, local public health department, or the mother's primary care physician. Two (13%) of the 16 mothers referred off-site were vaccinated, including one who was vaccinated at 38 weeks' gestation. In only one case was the Tdap dose documented in the mother's medical record. Among the 27 providers who did not stock Tdap vaccine on-site, the most common reasons cited for not stocking were cost (44%) and reimbursement (41%) issues.

TABLE 1. Reasons prenatal Tdap vaccination was not received during pregnancy among interviewed mothers of infants aged <4 months with pertussis (N = 40) — California, 2016

Reason	No. (%)
No recommendation or referral	10 (25)
Referred off-site, did not follow up	9 (23)
Refused for personal reasons	8 (20)
Invalid contraindication*	7 (18)
No prenatal care in third trimester	3 (8)
Valid contraindication	1 (3)
Unknown	2 (5)

Abbreviation: Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine.

* Invalid contraindications included prior receipt of prenatal Tdap (two); minor illness (two); previous illness associated with receipt of influenza vaccine (one); family member up to date with pertussis vaccination (one); and current medication use (one).

Discussion

In this review of 66 mothers of infants aged <4 months who became ill with pertussis in 2016, 20 mothers (30%) received Tdap vaccine during the time frame recommended by ACIP, all of whom were vaccinated in their prenatal clinic during a routine visit. Mothers whose providers stocked Tdap on-site were more likely to be vaccinated than were those whose providers did not stock Tdap. This finding is consistent with a previous survey demonstrating that receipt of influenza vaccine by pregnant women was more likely among those whose prenatal

TABLE 2. Prenatal Tdap vaccination outcomes for interviewed mothers of infants aged <4 months with pertussis (N = 60*), by clinic Tdap vaccine stocking policy and mothers' insurance coverage — California, 2016

Tdap policy/Insurance coverage	Tdap vaccination status no. (%)	
	Received per ACIP recommendations†	Not received on time or at all
Tdap stocked on-site in clinic (n = 34)		
Private insurance (n = 19)	14 (41)	5 (15)
Medicaid (n = 15)	6 (18)	9 (26)
Tdap not stocked on-site in clinic (n = 26)		
Private insurance (n = 7)	0 (—)	7 (27)
Medicaid (n = 19)	0 (—)	19 (73)
Unknown (n = 5)	0 (—)	5 (100)

Abbreviations: ACIP = Advisory Committee on Immunization Practices; Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis.

* Six of the 66 mothers interviewed were excluded because data on mother's insurance status, stocking status of Tdap vaccine by provider, or mothers' gestational week of pregnancy (if vaccinated) were incomplete.

† Among clinics that stocked Tdap vaccine on-site, 20 mothers received Tdap during 27–36 weeks' gestation.

care providers offered vaccination on-site (*4*). However, even when prenatal care providers stocked Tdap vaccine on-site, women insured by Medicaid were less likely to receive Tdap vaccination than were women with private insurance. Previous Tdap vaccination coverage estimates among pregnant women in California were also lower among those insured by Medicaid (40%) than among those with private insurance (65%) (*5*). Reasons for this disparity are not known; however, a need exists to reduce financial barriers to stocking and administering Tdap vaccine in prenatal clinics, particularly among those serving Medicaid patients.

To prevent pertussis among young infants, women should receive Tdap vaccination during 27–36 weeks' gestation during every pregnancy. A recommendation by prenatal care providers for their pregnant patients to receive Tdap is important, particularly among providers who do not stock Tdap vaccine on-site. If Tdap vaccine is not stocked on-site, it is important to provide pregnant patients with specific information* about where they can receive Tdap vaccination and to follow up at subsequent visits to ensure Tdap vaccine is received within the recommended time frame (*7*,*8*). Approximately 40% of the unvaccinated mothers in this analysis never received a recommendation or referral for Tdap vaccine or were deferred for reasons that were inconsistent with current ACIP recommendations, and 40% of the unvaccinated mothers, including one who originally refused Tdap vaccination, received Tdap vaccine postpartum, suggesting that prenatal-provider education about current Tdap vaccine recommendations is needed. Eight (20%) of the 40 mothers who were not vaccinated during pregnancy refused prenatal Tdap.

Fewer infants of mothers who were vaccinated according to recommendations required hospitalization after developing pertussis than did infants of unvaccinated mothers. Although not statistically significant, this difference is consistent with a previous report and highlights the importance of prenatal Tdap vaccination in preventing severe outcomes of pertussis (*9*).

The findings in this report are subject to at least one limitation. The relatively small sample size might affect the generalizability of these findings to the U.S. population of pregnant women and their prenatal care providers.

In California, pharmacists are permitted to provide immunizations, and all routinely recommended adult vaccines are covered by Medicaid when given in a provider's office or in a pharmacy. Recent state regulations require pharmacists to notify providers of immunizations administered and to enter all doses into the California Immunization Registry, making it possible for providers to know whether vaccine referrals to pharmacies are successful. However, stocking vaccines on-site in prenatal clinics is the best way to ensure that all pregnant women are vaccinated and reduce the incidence of pertussis among infants too young to be vaccinated.

* http://eziz.org/resources/pertussis-promo-materials/prenatal-tdap/.

Summary

What is already known about this topic?

Although tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination is recommended for all pregnant women during 27–36 weeks' gestation to prevent infant pertussis, coverage among pregnant women is suboptimal.

What is added by this report?

Among 66 interviewed mothers of infants aged <4 months with pertussis, 30% appropriately received Tdap vaccine. Women whose clinics stocked Tdap vaccine were more likely to be vaccinated. Women with Medicaid were less likely to be vaccinated than were those with private insurance, even when treated in clinics that stocked Tdap vaccine.

What are the implications for public health practice?

Promoting on-site prenatal vaccination, educating providers about Tdap recommendations, and strengthening off-site referral likely will improve Tdap vaccination coverage during pregnancy.

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Current Tobacco Smoking, Quit Attempts, and Knowledge About Smoking Risks Among Persons Aged ≥15 Years — Global Adult Tobacco Survey, 28 Countries, 2008–2016

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Each year, tobacco use causes approximately 7 million deaths worldwide, including approximately 6 million among tobacco users and an estimated 890,000 among nonsmokers exposed to secondhand smoke (*1*). Tobacco use is a leading preventable cause of disease globally and has been determined to cause adverse health outcomes such as coronary heart disease, stroke, and multiple types of cancer, including lung cancer (*2–4*). Approximately 80% of the world's 1.1 billion tobacco smokers reside in low- and middle-income countries (*4*). Some persons do not fully understand the health risks associated with tobacco smoking (*5–9*), and studies have indicated that increasing knowledge about the adverse health effects of smoking can contribute to decreases in smoking, increases in cessation attempts, and increases in successful cessation (*3,7,10*). CDC analyzed 2008–2016 Global Adult Tobacco Survey (GATS) data from 28 countries to assess tobacco smoking prevalence, quit attempts, and knowledge about tobacco smoking risks among persons aged ≥15 years. Across countries, the median prevalence of tobacco smoking was 22.5%, and a median of 42.5% of tobacco smokers had made a quit attempt in the preceding 12 months. The median prevalences of knowing that tobacco smoking causes stroke, heart attack, and lung cancer were 73.6%, 83.6%, and 95.2%, respectively. Implementation of proven tobacco control interventions, including strategies that increase knowledge about the health risks posed by tobacco use, might help to reduce tobacco use and tobacco-related disease, including heart disease, stroke, and lung cancer (*3–5*).

GATS is a nationally representative household survey of noninstitutionalized persons aged ≥15 years that uses a standard core questionnaire, sample design, and data collection methods. GATS was conducted in 28 countries during 2008–2016, with sample sizes ranging from 4,250 (Malaysia) to 74,037 (India). The median response rate was 92.0% (range = 64.4% [Ukraine] to 98.5% [Qatar]). The most recent publically available data for each country were used for analysis. Data were adjusted for nonresponse and weighted to provide nationally representative estimates for persons aged ≥15 years.

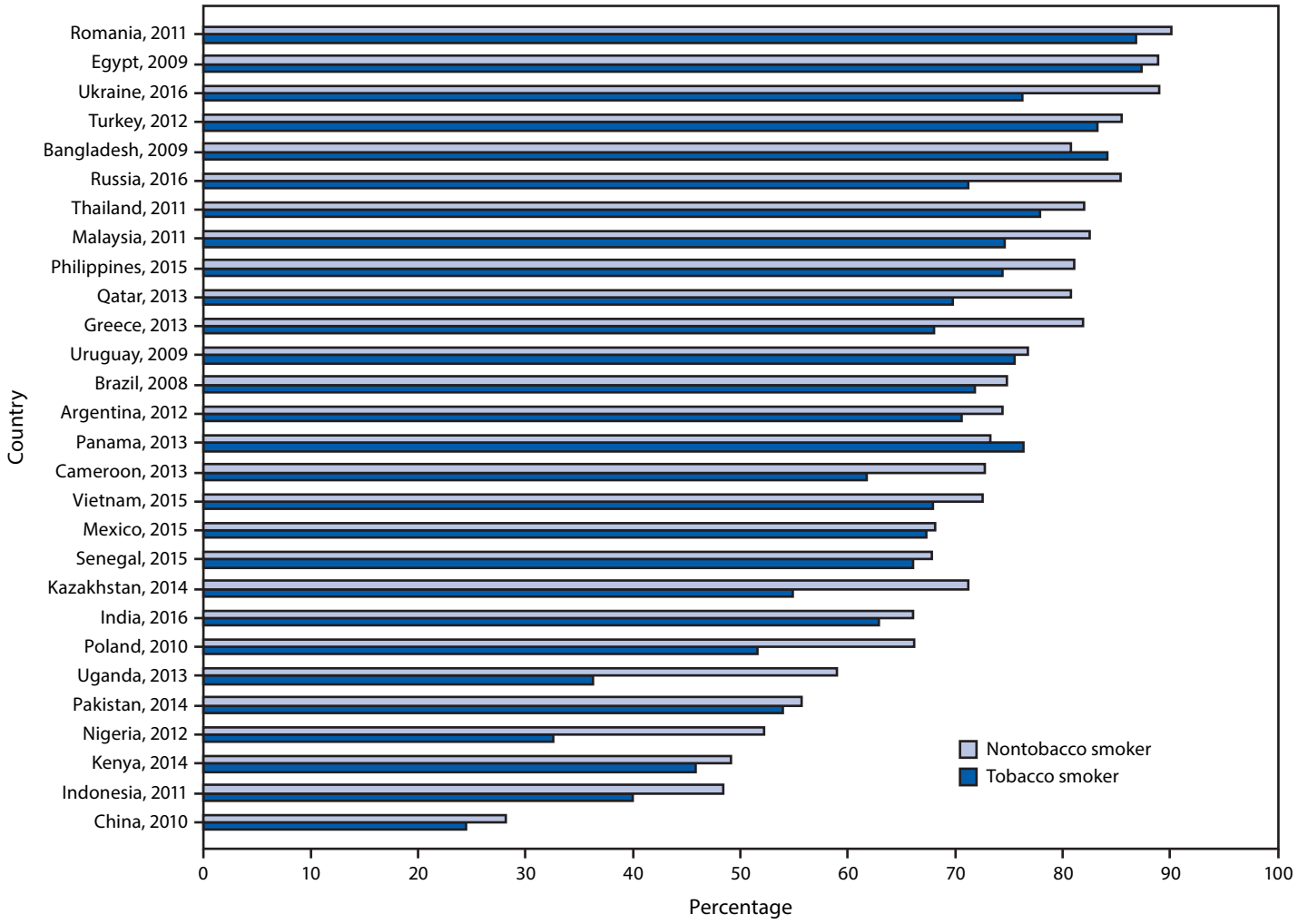
Current tobacco smokers* were defined as persons who, when asked "Do you currently smoke tobacco on a daily basis, less than daily, or not at all?" responded "daily" or "less than daily." Tobacco smokers who made a quit attempt were defined as those who answered "yes" to the question "During the past 12 months, have you tried to stop smoking?" Knowledge that tobacco smoking causes stroke, heart attack, and lung cancer was defined as an answer of "yes" to the question "Based on what you know/believe, does smoking tobacco cause the following: Stroke (blood clots in the brain that may cause paralysis)? Heart attack? Lung cancer?" These three health outcomes were selected for analysis because they were asked by all countries as part of the core GATS questionnaire. Changes in these indictors over time were examined for eight countries with two available waves of data.

Overall country-specific prevalence estimates with corresponding 95% confidence intervals were calculated for current tobacco smoking, quit attempts, and knowledge that smoking causes stroke, heart attack, and lung cancer. Chi-squared tests were used to assess significant differences (p-value <0.05) between groups and across countries with two available waves of data. All analyses were conducted using statistical software.

Across all 28 countries, the median prevalence of current tobacco smoking was 22.5%, ranging from 3.9% (95% CI = 3.3–4.5) in Nigeria to 38.2% (95% CI = 35.7–40.8) in Greece. Among current smokers, the median prevalence of a reported past-year quit attempt was 42.5%, ranging from 14.4% (95% CI = 11.9–17.2) in China to 59.6% (95% CI = 52.4–66.5) in Senegal (Supplementary Table, https://stacks.cdc.gov/view/cdc/58990). Overall median prevalence of knowledge about adverse health outcomes caused by tobacco smoking was 73.6% for stroke (range = 27.2% in China to 89.2% in Romania), 83.6% for heart attack (range = 38.7% in China to 95.5% in Turkey), and 95.2% for lung cancer (range = 73.0% in Nigeria to 98.6% Argentina). Knowledge that smoking causes stroke (Figure 1), heart attack (Figure 2), and lung cancer (Figure 3) was significantly higher among nonsmokers than among smokers in 19, 20, and 20 countries, respectively. Eight countries with data from multiple years indicated that, in general, there were significant increases in knowledge about most indicators (Table).

*The definition of smoking did not include electronic cigarettes, noncombustible tobacco products, and newer product such as heated tobacco products (referred to as "heat-not-burned" by the tobacco industry).

FIGURE 1. Percentage of respondents who knew that tobacco smoking causes stroke, by tobacco smoking status and country — Global Adult Tobacco Survey, 28 countries,* 2008–2016



* Statistically significant differences between nontobacco smokers and tobacco smokers ($p<0.05$) occurred in Bangladesh (2009), Brazil (2008), Cameroon (2013), China (2010), Greece (2013), India (2016), Indonesia (2011), Kazakhstan (2014), Malaysia (2011), Nigeria (2012), Philippines (2015), Poland (2010), Qatar (2013), Romania (2011), Russia (2016), Thailand (2011), Uganda (2013), Ukraine (2016), and Vietnam (2015).

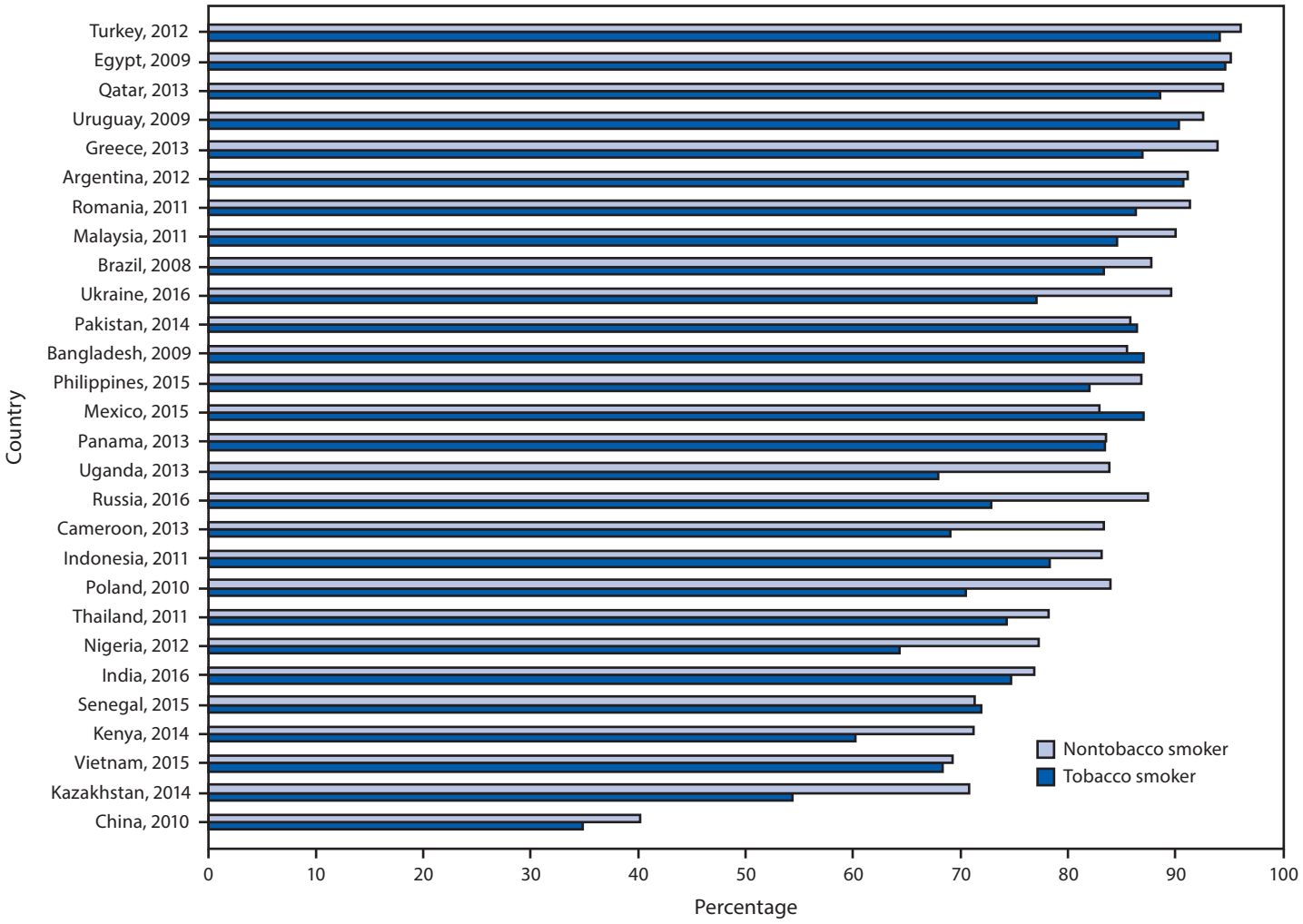
Discussion

Current tobacco smoking prevalence remains high in many of the assessed countries, and in 24 of 28 countries, fewer than half of current tobacco smokers had made a past-year quit attempt. Although knowledge about the risks posed by smoking was high across most countries, knowledge prevalence was generally lower among smokers than nonsmokers. In eight countries with two waves of available data, knowledge increased, although it varied among countries by indicator and whether or not the respondent was a smoker. Knowledge regarding the dangers of tobacco smoking is important for developing evidence-based interventions to reduce tobacco use (*2*,*7*,*9*), which is critical to reducing premature mortality from noncommunicable diseases (*4*). Opportunities exist for countries to increase tobacco cessation and prevent initiation through proven strategies that warn about the dangers of tobacco smoking and promote the benefits of quitting (*3*–*5*).

Implementation of the World Health Organization (WHO) Framework Convention of Tobacco Control (FCTC)† and

† Article 12 of the WHO FCTC states "Each Party shall promote and strengthen public awareness of tobacco control issues, using all available communication tools, as appropriate. Toward this end, each Party shall adopt and implement effective legislative, executive, administrative or other measures to promote: (b) Public awareness about the health risks for tobacco consumption and exposure to tobacco smoke, and about the benefits of the cessation of tobacco use and tobacco-free lifestyles as specified in Article 14.2.; (f) Public awareness of and access to information regarding the adverse health, economic, and environmental consequences of tobacco production and consumption." http://apps.who.int/iris/bitstream/handle/10665/42811/9241591013.pdf;jsessionid=F1A7FFF03B5BF40033AEBE82E1590520?sequence=1.

FIGURE 2. Percentage of respondents who knew that tobacco smoking causes heart attack, by tobacco smoking status and country — Global Adult Tobacco Survey, 28 countries,* 2008–2016



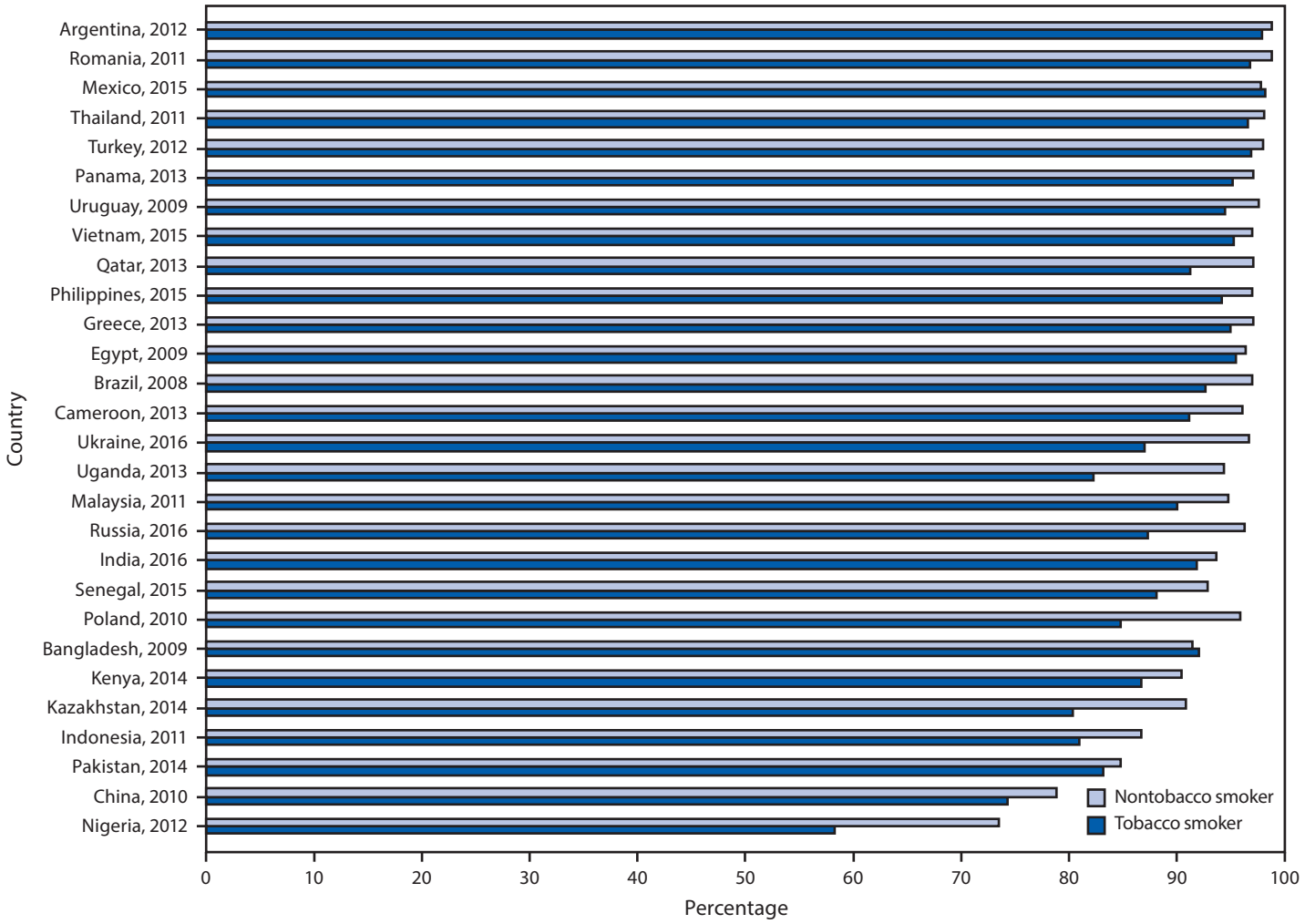
* Statistically significant differences between nontobacco smokers and tobacco smokers ($p<0.05$) occurred in Brazil (2008), Cameroon (2013), China (2010), Greece (2013), India (2016), Indonesia (2011), Kazakhstan (2014), Kenya (2014), Malaysia (2011), Mexico (2015), Nigeria (2012), Philippines (2015), Poland (2010), Qatar (2013), Romania (2011), Russia (2016), Thailand (2011), Turkey (2012), Uganda (2013), and Ukraine (2016).

MPOWER[§] might reduce tobacco use. The WHO FCTC calls for its Parties to adopt and implement measures to reduce tobacco use. MPOWER is a package of six evidence-based tobacco demand reduction policies developed by WHO to help implement the WHO FCTC at the country level. This study found that knowledge about the risks for tobacco smoking was significantly lower among smokers than among nonsmokers in the majority of countries; this lack of knowledge might contribute to fewer smokers making a quit attempt. One of the MPOWER measures includes warning about the dangers of tobacco via graphic health warning labels and mass media campaigns to increase knowledge that smoking causes chronic disease. Adopting these strategies to increase knowledge about the risks for smoking could help decrease tobacco smoking prevalence, increase cessation attempts, and increase successful cessation (*3*,*7*).

The WHO FCTC and MPOWER demand-reduction package outlines an evidence base for countries to use to respond to the tobacco epidemic by implementing specific programs and policies (*3*–*5*). As of January 2018, 181 countries and members have ratified the WHO FCTC, including all 28 countries included in this report. In 2015, the United Nations General Assembly, including countries that were signatories of WHO FCTC, adopted the 2030 Agenda for Sustainable Development, which includes multiple development goals; one

[§] The six components of MPOWER are "monitor" tobacco use and prevention policies; "protect" people from tobacco smoke; "offer" help to quit tobacco use; "warn about the dangers of tobacco; "enforce" bans on tobacco advertising, promotion, and sponsorship; and "raise" taxes on tobacco. http://www.who.int/tobacco/mpower/mpower_report_full_2008.pdf.

FIGURE 3. Percentage of respondents who knew that tobacco smoking causes lung cancer, by tobacco smoking status and country — Global Adult Tobacco Survey, 28 countries,* 2008–2016



* Statistically significant differences between non-tobacco smokers and tobacco smokers ($p<0.05$) occurred in Brazil (2008), Cameroon (2013), China (2010), Greece (2013), India (2016), Indonesia (2011), Kazakhstan (2014), Malaysia (2011), Nigeria (2012), Philippines (2015), Poland (2010), Qatar (2013), Romania (2011), Russia (2016), Thailand (2011), Turkey (2012), Uganda (2013), Ukraine (2016), Uruguay (2009), and Vietnam (2015).

of these (Goal 3) focuses specifically on improving health.[¶] Two targets related to Goal 3 include strengthening the implementation of the WHO FCTC in all countries (Target 3.A.1) and reducing noncommunicable disease mortality by one third by 2030 (Target 3.4). Countries monitor both targets by assessing reductions in tobacco use.

The findings in this report are subject to at least four limitations. First, data were self-reported, which might result in misreporting of smoking behavior. Second, only a limited number of countries were assessed; thus, the findings in this report might not be generalizable to all countries. Third, the data were collected in different years, which might not represent current tobacco use prevalence, awareness, and knowledge. Finally, the indicator assessing knowledge of the risks for tobacco simultaneously inquired about both respondents' knowledge and beliefs related to each outcome; thus, it was not possible to differentiate between these two constructs.

Although overall knowledge that smoking causes lung cancer, heart attack, and stroke is relatively high in most countries, opportunities exist to increase this knowledge across all countries and populations, including among current tobacco smokers. Implementation of the evidence-based measures outlined in the WHO FCTC and MPOWER, which include mass media campaigns and graphic health warning labels on tobacco products, can increase knowledge that smoking causes

[¶] Sustainable Development Goal 3 — Good Health and Well-Being states "Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development… However, many more efforts are needed to fully eradicate a wide range of diseases and address many different persistent and emerging health issues." https://www.un.org/sustainabledevelopment/health/.

TABLE. Relative change* in knowledge/belief that tobacco smoking causes stroke, heart attack, and lung cancer, overall and by smoking status for countries with two waves of data — Global Adult Tobacco Survey, 2008–2017

Country, yrs of survey	Smoking status	Stroke	Heart attack	Lung cancer
India, 2009/10 and 2016/17	Overall	33.2†	43.2†	31.6†
	Smoker	19.9†	29.6†	18.4†
	Nonsmoker	10.1†	13.8†	9.4†
Mexico, 2009 and 2015	Overall	12.5†	14.9†	12.0†
	Smoker	4.8†	4.9†	4.8†
	Nonsmoker	1.2†	1.3†	1.1†
Philippines, 2009 and 2015	Overall	8.6†	15.0†	5.8†
	Smoker	8.6†	15.8†	5.7†
	Nonsmoker	3.9†	8.5†	2.0†
Russia, 2009 and 2016	Overall	20.6†	30.4†	13.3†
	Smoker	16.9†	22.0†	11.7†
	Nonsmoker	2.6†	3.0	1.0
Thailand, 2009 and 2011	Overall	1.8	-0.2	2.4†
	Smoker	2.0	2.2	2.0
	Nonsmoker	0.3	0.4	0.3
Turkey, 2008 and 2012	Overall	3.4†	1.1	4.3†
	Smoker	2.1†	0.2	2.8†
	Nonsmoker	1.7†	0.4	2.2†
Ukraine, 2010 and 2017	Overall	10.5†	10.8†	9.0†
	Smoker	9.4†	8.9†	8.3†
	Nonsmoker	3.6†	0.4	3.9†
Vietnam, 2010 and 2015	Overall	1.7	7.2†	0.1
	Smoker	10.3†	22.8†	6.9†
	Nonsmoker	1.1†	3.9†	0.3

* Relative change is calculated as ([percent at second wave (t2) - percent at first wave (t1)] / percent at first wave [t1])*100.
† Statistically significant, p<0.05.

noncommunicable diseases such as chronic disease, including stroke, heart attack, and lung cancer. Increasing knowledge about the risks posed by tobacco smoking could help curb the estimated 1 billion tobacco-related deaths projected to occur in the 21st century (*3*–*5*,*7*,*9*).

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Summary

What is already known about this topic?

Smoking is a leading preventable cause of disease globally, and increasing knowledge of the health effects of smoking can help to decrease smoking and increase successful cessation.

What is added by this report?

Across 28 countries, the median prevalences of tobacco smoking and smokers making a quit attempt were 22.5% and 42.5%, respectively. The median prevalences of knowing that tobacco smoking causes stroke, heart attack, and lung cancer were 73.6%, 83.6%, and 95.2%, respectively.

What are the implications for public health practice?

Implementation of proven tobacco control interventions, including strategies that increase knowledge about the health risks of tobacco use, could reduce tobacco use and tobacco-related diseases, including stroke, heart attack, and lung cancer.

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Notes from the Field

Blastomycosis Cases Occurring Outside of Regions with Known Endemicity — New York, 2007–2017

Robert McDonald, MD[1,2]; Elizabeth Dufort, MD[2]; Brendan R. Jackson, MD[3]; Ellis H. Tobin, MD[4]; Alexandra Newman, DVM[2]; Kaitlin Benedict, MPH[3]; Debra Blog, MD[2]

In October 2017, the New York State Department of Health was alerted by Albany-area infectious disease physicians about local cases of blastomycosis, including multiple severe infections, in the state health department's Capital District, an area where *Blastomyces* spp. fungi are not considered endemic. The majority of patients reported no travel to regions where blastomycosis is known to be endemic, prompting a state investigation of the disease. Blastomycosis is reportable in only five states (Arkansas, Louisiana, Michigan, Minnesota, and Wisconsin); it is not reportable in New York. To evaluate New York blastomycosis trends, statewide health care data were reviewed for the period 2007–June 2017, and incidence in one county in the Capital District was found to be particularly high. Although not a reportable disease, as an emerging infectious disease in New York, suspected blastomycosis should be reported to local health departments where patients reside.

Blastomycosis is an uncommon and underdiagnosed disease caused by inhalation of *Blastomyces* spp. fungi, which grow in moist soil and organic matter. Based on reports of animal and human cases, *Blastomyces* spp. are thought to be endemic in areas of North America along the Great Lakes and the Mississippi, Ohio, and Saint Lawrence River valleys (*1*). Unlike the similar fungal diseases coccidioidomycosis and histoplasmosis, a skin test has not been available to assess geographic distribution of exposure. Data regarding blastomycosis in New York are limited, with reports of canine infections suggesting endemicity along the Saint Lawrence River on the New York-Canada border (*2*). Outdoor exposures and proximity to waterways have been associated with the disease; however, little about its ecology and epidemiology is known.

Pneumonia is the most common manifestation of blastomycosis. Approximately half of blastomycosis infections can be asymptomatic; however, infection can lead to severe and fatal disease, often from respiratory failure. Disseminated infection can involve any organ, often including cutaneous abscesses and osteomyelitis, and is frequently accompanied by fever, weight loss, and night sweats. Blastomycosis is treated with antifungal medications, typically itraconazole or another azole for mild or moderate disease and lipid formulations of amphotericin B for severe disease. Delays in diagnosis of more than 1 month have been observed in >40% of patients (*3*), suggesting that a diagnosis of blastomycosis is often not considered until after other treatments have failed. Blastomycosis diagnosis can be confirmed by fungal culture, with the optimal specimen source depending on the type of infection. Pulmonary blastomycosis can be detected on sputum and lower respiratory cultures. *Blastomyces* spp. also can be identified on histopathology. Polymerase chain reaction can be used to confirm culture or histopathologic identification and on blood to detect disseminated disease. *Blastomyces* spp. antigen and antibody tests can aid in diagnosis, although clinicians should be aware that these tests have limited sensitivity and can cross-react with *Histoplasma capsulatum* and other fungi (*4*).

A 2012 epidemiologic and ecologic review found that in Illinois and Wisconsin, where blastomycosis is considered endemic, the range of annual incidence was 0.4–2.6 cases per 100,000 population (*1*). To evaluate New York blastomycosis trends, statewide hospital, emergency department, and hospital-associated outpatient *International Classification of Diseases* (ICD) codes from the Statewide Planning and Research Cooperative System data set were reviewed for the period 2007–June 2017. During 2007–2015, blastomycosis ICD codes were identified for an annual mean of 24 (range = 17–30) patients (average annual incidence = 0.1 cases per 100,000 population). In 2016, blastomycosis ICD codes were identified for 59 patients (incidence = 0.2 cases per 100,000). Preliminary data from the first 6 months of 2017 include 25 patients, above the previous annual mean. Incidence in one county along the Mohawk River in the Capital District was particularly high, with a mean of 2.2 cases per 100,000 (range = 0–6.1) during 2007–2016. Travel and exposure information were not available.

Although ICD codes likely involve misclassification, identifying only a small proportion of infections, these data, combined with case reports, indicate that blastomycosis might be endemic in eastern upstate New York. These findings, along with reported cases of blastomycosis in Texas, Kansas, Nebraska (*5*), and Vermont (*6*), highlight limitations of the existing blastomycosis endemic map* and the need for better data.

Active blastomycosis case finding is under way in New York, as is investigation of passively reported cases to assess common exposures, better characterize risk factors, and evaluate a possible common source associated with the high incidence in the county along the Mohawk River. Although blastomycosis is not currently a reportable disease, health care

* https://www.cdc.gov/fungal/diseases/blastomycosis/causes.html.

providers and health care facilities should report suspected cases as an emerging infectious disease in New York to local health departments where patients reside. To prevent delays in diagnosis, which can lead to more severe illness and death, clinicians and laboratorians should be aware that blastomycosis can be acquired in areas outside of regions where the disease is considered endemic and to consider the diagnosis in patients with compatible signs and symptoms.

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All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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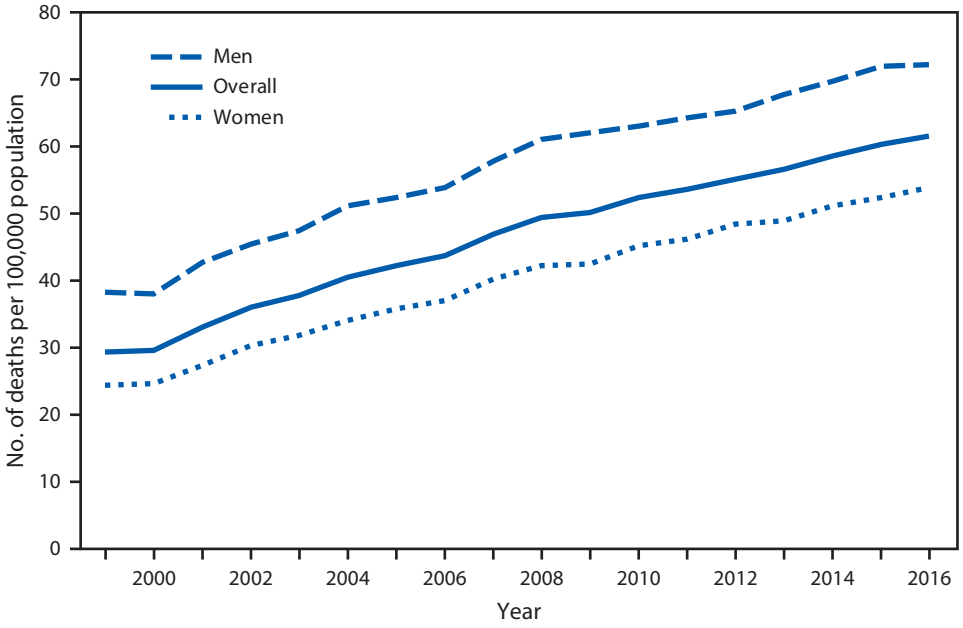
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* from Unintentional Falls† Among Adults Aged ≥65 Years, by Sex — National Vital Statistics System, 1999–2016



* Deaths per 100,000 population, age-adjusted to the 2000 U.S. standard population.
† As underlying cause of death, unintentional fall-related deaths are identified with the *International Classification of Diseases, Tenth Revision* codes W00–W19.

From 1999 to 2016, age-adjusted death rates from unintentional falls among adults aged ≥65 years increased 110% from 29.4 to 61.6 per 100,000. Among men aged ≥65 years, the age-adjusted death rate increased 89% from 38.3 per 100,000 in 1999 to 72.3 in 2016. For women aged ≥65 years, the rate increased 122% from 24.3 per 100,000 in 1999 to 54.0 in 2016. Throughout the period, death rates from unintentional falls were higher for men than women.

Source: National Vital Statistics System, 1999–2016. https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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For more information on this topic, CDC recommends the following link: https://www.cdc.gov/homeandrecreationalsafety/falls/index.html.

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