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Influenza Vaccination Coverage Among Health-Care Personnel — 2011–12 Influenza Season, United States

Influenza vaccination of health-care personnel (HCP) is recommended by the Advisory Committee on Immunization Practices (ACIP) (*1*). Vaccination of HCP can reduce morbidity and mortality from influenza and its potentially serious consequences among HCP, their family members, and their patients (*1–3*). To provide timely estimates of influenza vaccination coverage and related data among HCP for the 2011–12 influenza season, CDC conducted an Internet panel survey with 2,348 HCP during April 2–20, 2012. This report summarizes the results of that survey, which found that, overall, 66.9% of HCP reported having had an influenza vaccination for the 2011–12 season. By occupation, vaccination coverage was 85.6% among physicians, 77.9% among nurses, and 62.8% among all other HCP participating in the survey. Vaccination coverage was 76.9% among HCP working in hospitals, 67.7% among those in physician offices, and 52.4% among those in long-term care facilities (LTCFs). Among HCP working in hospitals that required influenza vaccination, coverage was 95.2%; among HCP in hospitals not requiring vaccination, coverage was 68.2%. Widespread implementation of comprehensive HCP influenza vaccination strategies is needed, particularly among those who are not physicians or nurses and who work in LTCFs, to increase HCP vaccination coverage and minimize the risk for medical-care–acquired influenza illnesses.

For the Internet panel survey, two source populations were recruited through e-mails and pop-up invitations. Clinical professionals (e.g., physicians, nurses, and other health professionals [dentists, nurse practitioners, and physician's assistants]) were recruited from the current membership roster of Medscape, a web portal managed by WebMD Professional Services. Other HCP such as assistants, aides, administrators, clerical support workers, janitors, food service workers, and housekeepers were recruited for a health survey from SurveySpot, a general population Internet panel operated by Survey Sampling International that provides its members with online survey opportunities in exchange for nominal cash and rewards.* Among the 2,518 HCP who completed the screening questions and entered the two panel survey sites, 2,348 (93.2%) completed the survey.† Of those, 1,724 (73.4%) were clinical professionals, and 624 (26.6%) were other HCP.

Survey categories included demographics, occupation type, work setting, self-reported influenza vaccination, reasons for nonvaccination during the current influenza season, and employer vaccination policies. Based on their responses to the questionnaire, HCP from both Internet sources were divided into three groups for this analysis: physicians, nurses, and all other HCP with occupations listed on the screening questionnaire. Sampling weights were calculated based on each occupation type by age, sex, race/ethnicity, medical-care setting, and census region to be more representative of the U.S. population of HCP. Because opt-in Internet panel surveys are not random

* Additional information available at http://www.surveysampling.com.

† 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 panel used for this report, these numbers are not available; therefore, the response rate cannot be calculated. Instead, the survey completion rate is provided.

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samples, statistical measures such as computation of confidence intervals and tests of differences cannot be performed.[§]

By occupation, influenza vaccination was most common among physicians (85.6%), followed by nurses (77.9%), and other HCP (62.8%) (Table). Vaccination coverage was 76.9% among HCP working in hospitals, 67.7% among those in physician offices, and 52.4% among those in long-term care facilities (LTCFs). By occupation and work setting, influenza vaccination was most common among physicians who worked in hospitals (86.7%) and lowest among other HCP who worked in LTCFs (50.2%) (Table). Among HCP working in hospitals that required influenza vaccination, coverage was 95.2%; among HCP in hospitals not requiring vaccination, coverage was 68.2%.

Coverage among HCP aged ≥60 years (75.7%) was higher than coverage for other age groups. Among racial/ethnic groups, coverage did not differ more than 5 percentage points. Vaccination coverage was higher among HCP with vaccination available at no cost on multiple days at their worksite (78.4%), compared with those not offered vaccination at no cost (48.4%). Overall, 496 (21.1%) of participating HCP reported being required to be vaccinated by their employers. Influenza vaccination was more common among those who reported that their employers promoted influenza vaccination (75.8%), compared with those whose employers did not promote influenza vaccination (55.8%) (Table).

Overall, 33.1% of HCP reported not receiving influenza vaccination. The three most common answers to a question asking for the main reason a participant did not get vaccinated for influenza were 1) a belief that they did not need it (28.1%), followed by 2) concern about vaccination effectiveness (26.4%) and 3) concern about side effects (25.1%).

[§] Additional information available at http://www.aapor.org/opt_in_surveys_and_margin_of_error1.htm.

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Editorial Note

The overall HCP influenza vaccination coverage estimate from this Internet panel survey for the 2011–12 season was 66.9%, compared with previous CDC Internet panel estimates, from

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TABLE. Percentage of health-care personnel (HCP)* who received Influenza vaccination, by selected characteristics — Internet panel surveys, United States, 2011–12 influenza season

Characteristic	Unweighted no. of participants in sample	% vaccinated†	Percentage point change from 2010–11 survey
Overall	**2,348**	**66.9**	**3.4**
Occupation by work setting			
Physician	418	85.6	1.4
Hospital	247	86.7	5.4
Physician office	311	86.2	0.0
Long-term care facility	—§	—§	—§
Other work setting¶	—§	—§	—§
Nurse	373	77.9	8.1
Hospital	252	78.1	2.7
Physician office	91	75.6	1.4
Long-term care facility	54	72.2	—§
Other work setting¶	—§	—§	—§
All other HCP**	1,557	62.8	1.8
Hospital	688	75.5	6.5
Physician office	345	62.1	7.5
Long-term care facility	375	50.2	-16.7
Other work setting¶	261	58.4	6.3
Work setting			
Hospital	1,187	76.9	5.8
Physician office	747	67.7	6.2
Long-term care facility	455	52.4	-12.0
Other work setting¶	277	61.5	9.1
Age group (yrs)			
18–29	228	63.9	7.5
30–44	690	68.8	11.0
45–59	962	63.8	-5.2
≥60	332	75.7	1.5
Race/Ethnicity			
White, non-Hispanic	1,427	66.4	-0.2
Black, non-Hispanic	344	65.5	4.4
Hispanic	334	70.3	12.7
Other or multiple race, non-Hispanic††	243	69.0	19.4
Vaccination available at no cost			
More than 1 day	1,355	78.4	3.6
1 day	297	67.7	15.6
None	682	48.4	6.7

TABLE. (*Continued*) Percentage of health-care personnel (HCP)* who received Influenza vaccination, by selected characteristics — Internet panel surveys, United States, 2011–12 influenza season

Characteristic	Unweighted no. of participants in sample	% vaccinated†	Percentage point change from 2010–11 survey
Required by employer to be vaccinated			
Yes	496	93.7	-4.4
Hospital	362	95.2	-2.9
Non-hospital	134	91.3	-6.7
No	1,829	59.7	1.4
Hospital	818	68.2	4.7
Nonhospital	1,011	55.0	-0.4
Employer promotion§§	390	75.8	11.1
Hospital	253	75.3	13.4
Nonhospital	134	76.3	8.4
No requirement or promotion	1,450	55.8	-1.3
Hospital	561	65.9	1.7
Nonhospital	865	51.5	-1.6

Source: CDC. Influenza vaccination coverage among health-care personnel—United States, 2010–11 influenza season. MMWR 2011;60:1073–7.

* Persons who worked in a medical-care setting or whose work involved hands-on care of patients.

† Weighted estimate. Sampling weights were calculated based on each occupation type by age, sex, race/ethnicity, medical-care setting, and census region to be more representative of the U.S. population of HCP.

§ Estimate suppressed because sample size was <30.

¶ Included dental offices, pharmacies, nonhospital laboratories, medical-related schools, emergency medical technician sites, and home medical-care sites.

** Includes dentists, nurse practitioners or physician's assistants, allied health professionals, technicians or technologists, assistants or aides, administrative support staff members or managers, and nonclinical support staff members (e.g., food service workers, housekeeping staff members, maintenance staff members, janitors, and laundry workers).

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

§§ Employer promoted influenza vaccination among employees through public recognition of vaccinated persons; financial incentives or rewards to persons; incentives or reminders/invitations, and special events.

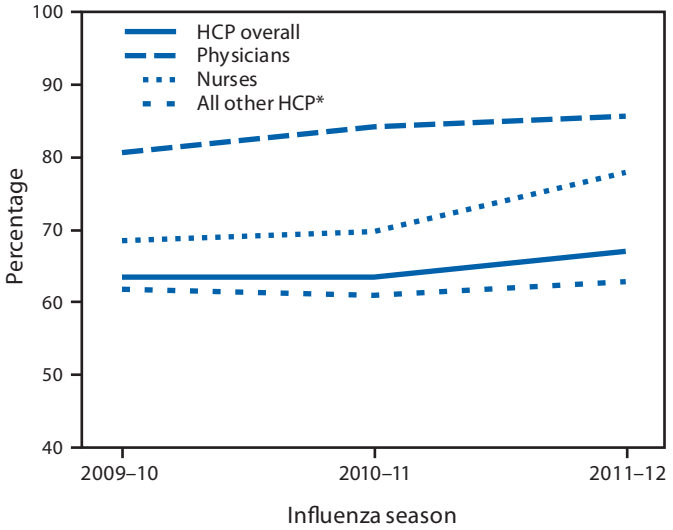
two surveys with varying methods, of 63.5% for the 2010–11 season (*4*) and 63.4% for the 2009–10 season (*5*) (Figure 1). Earlier estimates of influenza vaccination coverage levels in HCP based on the National Health Interview Survey (NHIS) were 10% in 1989, 38% in 2002 (*6*), and 49% in 2008 (*7*). In the Internet panel surveys for the three most recent influenza seasons, vaccination coverage was highest among physicians and nurses and lowest among all other HCP. From the 2009–10 season to the 2011–12 season, coverage increased among physicians from 80.5% to 85.6%, and among nurses from 68.5% to 77.9%. Coverage among all other HCP was similar from 2009–10 through 2011–12 in the Internet panel surveys.

For certain categories, vaccination coverage among HCP differed from 2010–11 to 2011–12, according to the Internet panel surveys. Coverage in physician's office settings increased from 61.5% during the 2010–11 season to 67.7% during the 2011–12 season, and coverage in hospitals increased from 71.1% to 76.9% (*4*). Among LTCFs, influenza vaccination coverage was lower in 2011–12 (52.4%), compared with 2010–11 (64.4%). The 2011–12 coverage in work settings other than hospitals, physician's offices, and LTCFs was higher (61.5%) than in 2010–11 (52.4%) (*4*) (Figure 2).

For the 2011–12 influenza season, vaccination coverage among physicians (85.6%) neared the *Healthy People 2020* target of 90% (*8*). Among HCP work settings, hospitals were associated with the highest coverage, whereas coverage was lowest among HCP other than physicians and nurses working in LTCFs. Increased vaccination coverage was associated with employer vaccination requirements, employer promotion of HCP vaccination, and vaccination offered at no cost for multiple days.

These results indicate that targeted intervention and promotion programs developed for HCP groups other than physicians

FIGURE 1. Percentage of health-care personnel (HCP) who received influenza vaccination, by occupation — Internet panel surveys, United States, 2009–10, 2010–11, and 2011–12 influenza seasons

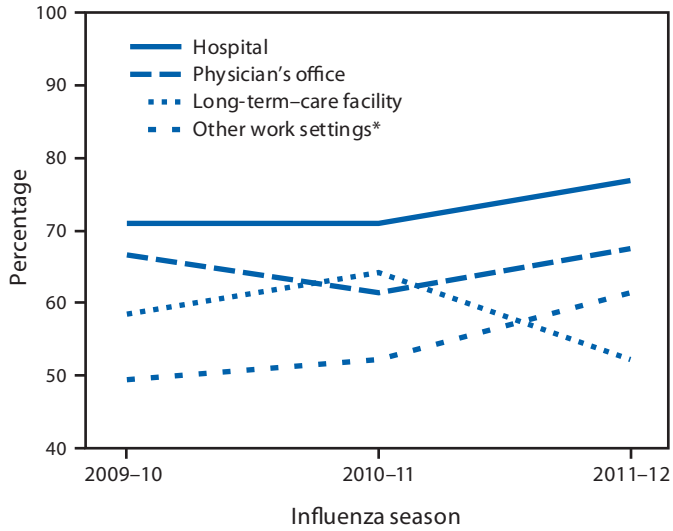


Sources: CDC. Interim results: influenza A (H1N1) 2009 monovalent and seasonal influenza vaccination coverage among health-care personnel—United States, August 2009–January 2010. MMWR 2010;59:357–62.

CDC. Influenza vaccination coverage among health-care personnel—United States, 2010–11 influenza season. MMWR 2011;60:1073–7.

* Includes dentists, nurse practitioners or physician's assistants, allied health professionals, technicians or technologists, assistants or aides, administrative support staff members or managers, and nonclinical support staff members (e.g., food service workers, housekeeping staff members, maintenance staff members, janitors, and laundry workers).

FIGURE 2. Percentage of health-care personnel (HCP) who received influenza vaccination, by work setting — Internet panel surveys, United States, 2009–10, 2010–11, and 2011–12 influenza seasons



Sources: CDC. Interim results: influenza A (H1N1) 2009 monovalent and seasonal influenza vaccination coverage among health-care personnel—United States, August 2009–January 2010. MMWR 2010;59:357–62.

CDC. Influenza vaccination coverage among health-care personnel—United States, 2010–11 influenza season. MMWR 2011;60:1073–7.

* Includes dental offices, pharmacies, nonhospital laboratories, medical-related schools, emergency medical technician sites, and home medical-care sites.

What is already known on this topic?

To help reduce influenza-related morbidity and mortality that occurs in medical-care settings, the Advisory Committee on Immunization Practices recommends annual influenza vaccination for all health-care personnel (HCP). Estimates of overall HCP vaccination coverage were 63.4% and 63.5% from Internet panel surveys, and 57.5% and 55.8% from the National Health Interview Survey for the 2009–10 and 2010–11 seasons, respectively.

What is added by this report?

For the 2011–12 season, overall influenza vaccination coverage among HCP was 66.9%. By occupation and work setting, coverage was highest among physicians (86.7%) and nurses (78.1%) who worked in hospitals and lowest (50.2%) among other HCP who worked in long-term care facilities (LTCFs).

What are the implications for public health practice?

A comprehensive intervention strategy that includes targeted education, promotion to encourage vaccination, easy access to vaccine at no cost on multiple days, and routine monitoring can increase HCP influenza vaccination coverage. Beginning in January 2013, the Centers for Medicare & Medicaid Services (CMS) will require acute care hospitals to report HCP influenza vaccination levels as part of the Hospital Inpatient Quality Reporting Program. Targeted intervention and promotion programs developed specifically for HCP who are not physicians or nurses, and particularly for those who work in LTCFs, might be important components in improving overall HCP vaccination coverage.

and nurses, and especially for those who work in LTCFs, might be important components in improving overall HCP vaccination coverage. Raising vaccination coverage of HCP working in LTCFs is especially important given that LTCF residents are at increased risk for serious influenza complications and that HCP vaccination might reduce the risk for death among LTCF residents (*2,3*). To increase vaccination coverage for HCP, each medical-care facility should develop a comprehensive intervention strategy that includes education and promotion to encourage vaccination and easy access to vaccine at no cost. Educational programs should include emphasis on vaccination effectiveness and its safety, knowledge of influenza transmission, and the benefits of HCP vaccination for staff, patients, and family.

The findings in this report are subject to at least five limitations. First, the sample was not selected randomly from the approximately 18 million HCP in the United States. The sample consisted of a much smaller group of several thousand volunteer HCP (a nonprobability sample) who had already enrolled in Medscape or SurveySpot. Second, all results are based on self-report and are not verified by employment or medical records. Third, the definition of HCP used in this Internet panel survey might vary from definitions used in other surveys of vaccination coverage. Fourth, occupation categories

could not always be separated because of small sample sizes and questionnaire design or other limitations. Finally, the 2011–12 estimates might not be directly comparable to those made for previous influenza seasons using Internet survey panels and NHIS, because different methods of recruitment were used each year. Compared with the population-based estimates of NHIS, influenza vaccination among HCP from the Internet panel surveys differed (63.4% versus 57.5%) for 2009–10 (*5*). A similar difference (63.5% versus 55.8%) was observed for 2010–11 (*4*) (CDC, unpublished data, 2012).

A comprehensive intervention strategy that includes targeted education, promotion to encourage vaccination, and easy access to vaccination at no cost on multiple days can increase HCP vaccination coverage (*1*). Targeting undervaccinated HCP groups and regularly monitoring vaccination coverage are activities needed to stimulate increases in HCP influenza vaccination. CDC's National Healthcare Safety Network (NHSN), a longitudinal surveillance system, has introduced a module for reporting HCP influenza vaccination at the hospital level, based on the HCP influenza vaccination measure endorsed by the National Quality Forum (*9*). Beginning in January 2013, the Centers for Medicare & Medicaid Services will require acute care hospitals that they reimburse to report HCP influenza vaccination levels as part of the Hospital Inpatient Quality Reporting Program.¶ CDC will continue to use Internet panel surveys to monitor self-reported HCP vaccination coverage and reasons for nonvaccination across multiple occupation categories and work settings.

¶ Additional information available at http://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/hospitalrhqdapu.html.

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Influenza Vaccination Coverage Among Pregnant Women — 2011–12 Influenza Season, United States

Pregnant women and their newborns are at elevated risk for influenza-associated hospitalization and death (*1*). The Advisory Committee on Immunization Practices (ACIP) and the American College of Obstetricians and Gynecologists (ACOG) have recommended influenza vaccination for all women who are or will be pregnant during the influenza season, regardless of trimester (*1,2*). To estimate influenza vaccination coverage among pregnant women for the 2011–12 influenza season, CDC analyzed data from an Internet panel survey (*3*) conducted April 3–17, 2012, among women pregnant at any time during the 4-month period October 2011–January 2012. Among 1,660 survey respondents, 47.0% reported they had received influenza vaccination; 9.9% were vaccinated before pregnancy, 36.5% during pregnancy, and <1.0% after pregnancy. Overall, 43.7% of women reported receipt of both a health-care provider recommendation and offer of influenza vaccination; these women had higher vaccination coverage (73.6%) than women who received only a recommendation but no offer of vaccination (47.9%) and women who received neither a recommendation nor an offer (11.1%). Continued efforts are needed to encourage providers of medical care to routinely recommend and offer influenza vaccination to women who are pregnant or who might become pregnant.

To provide timely end-of-season estimates of influenza vaccination coverage and information on knowledge, attitudes, and behaviors related to influenza vaccination among women pregnant during the 2011–12 influenza season, CDC conducted an Internet panel survey during April 3–17, 2012 that was similar to a survey conducted in April 2011 (*3*). Women aged 18–49 years who were pregnant at any time since August 2011 were recruited from a SurveySpot panel operated by Survey Sampling International.* Of 7,485 women who visited the Internet survey site during the study period, 2,223 were determined to be eligible for the survey based on the timing of their pregnancies; of those, 2,096 (94%) completed the online survey. Data were weighted to reflect the age group, racial/ethnic, and geographic distribution of the total U.S. population of pregnant women during 1995–2005.† The same questions used to determine pregnancy status in the April 2011 survey (*3*) were used in this survey. In addition, women pregnant since August 2011 but no longer pregnant at the time of their response were asked to provide the start and end months of pregnancy. For this analysis, the study population was limited to 1,660 women reporting pregnancy any time during the usual peak influenza vaccination period of October 2011–January 2012.

Survey respondents were asked questions about their knowledge and attitudes regarding influenza and influenza vaccination; their vaccination status before, during, and after pregnancy; their physician's practices regarding influenza vaccination, place of vaccination, and reasons for not receiving influenza vaccination. Weighted analyses were conducted. Because opt-in Internet panels are not random samples, statistical measures such as compilation of confidence intervals and tests of differences cannot be performed.§

Of the 1,660 women pregnant at any time during October 2011–January 2012, 47.0% reported influenza vaccination since August 1, 2011: 9.9% were vaccinated before pregnancy; 36.5% during pregnancy; and 0.6% after pregnancy (Table 1). By trimester of pregnancy, the percentages vaccinated were similar (10.1%, 12.6%, and 11.8% during the 1st, 2nd, and 3rd trimester, respectively). Women aged 18–24 years had lower vaccination coverage (42.3%) than women aged 25–49 years (49.4%). Non-Hispanic black women had lower vaccination coverage (39.8%) than Hispanic women (48.8%), non-Hispanic white women (47.9%), and other non-Hispanic women (53.7%). Vaccination coverage estimates varied by U.S. Census regions from 43.9% in the south to 49.7% in the northeast (Table 1). Women with education beyond a college degree had higher coverage (61.3%) than those with a college degree (49.4%) or less than a college degree (42.8%). Women with private or military medical insurance had higher vaccination coverage (50.2%) than those without medical insurance (36.9%) (Table 1).

Of women in the April 2012 survey, 39.8% reported having received influenza vaccination for the 2010–11 influenza season. Among these women, vaccination coverage for the 2011–12 season was 86.5%, compared with 20.7% for those who did not receive vaccination for the 2010–11 season (Table 1).

Among women who received a health-care provider recommendation to be vaccinated, 81.6% were offered vaccination during a provider visit. Among women who received both a

* Additional information available at http://www.surveysampling.com.

† The sample of pregnant women was weighted to reflect the age group, racial/ethnic and geographic distribution of total pregnant women in the United States during 1995–2005. Source: CDC. Estimated pregnancy rates for the United States, 1990–2005: an update. Natl Vital Stat Rep 2009;58(4).

§ Additional information available at http://www.aapor.org/opt_in_surveys_and_margin_of_error1.htm.

TABLE 1. Percentage vaccinated among women pregnant at any time during October 2011–January 2012, by selected characteristics — Internet panel surveys, United States, 2011–12 influenza season

Characteristic	Unweighted no. of participants	Unweighted %	Weighted %	Weighted % vaccinated	Percentage point change from 2010–11 survey*
Vaccinated	**802**	**48.3**	—	**47.0**	**-2.0**
Before pregnancy	165	9.9	—	9.9	-1.8
During pregnancy	625	37.7	—	36.5	4.3
1st trimester	172	10.4	—	10.1	—
2nd trimester	218	13.1	—	12.6	—
3rd trimester	200	12.1	—	11.8	—
After pregnancy	12	0.7	—	0.6	-4.5
Unvaccinated	**858**	**51.7**		**53.0**	
Age group (yrs)					
18–24	428	25.8	33.8	42.3	-1.3
25–49	1,232	74.2	66.2	49.4	-2.4
Race/Ethnicity					
Hispanic	234	14.1	23.5	48.8	-4.4
White, non-Hispanic	1,179	71.0	54.2	47.9	1.4
Black, non-Hispanic	132	8.0	17.2	39.8	-7.3
Other, non-Hispanic	115	6.9	5.2	53.7	-10.1
Census regions					
Region 1: Northeast	273	16.5	17.4	49.7	-4.5
Region 2: Midwest	420	25.4	21.2	48.5	-6.1
Region 3: South	591	35.7	35.2	43.9	-0.5
Region 4: West	373	22.5	26.2	48.1	0.9
Education					
Less than college degree	845	50.9	55.5	42.8	-0.6
College degree only	603	36.3	34.3	49.4	-5.5
More than college degree	186	12.8	10.2	61.3	-5.6
Married					
Yes	1,161	69.9	64.3	49.1	-4.5
No	499	30.1	35.7	43.1	0.8
Medical coverage					
Any public	555	33.4	37.4	44.0	-2.2
Private/Military only	1,000	60.2	55.9	50.2	-3.9
None reported	105	6.3	6.7	36.9	1.9
Working status†					
Working	816	49.2	47.5	47.9	-6.7
Not working	843	50.8	52.5	46.2	1.6
Income§					
<$50,000	814	49.5	53.0	44.8	1.3
≥$50,000	832	50.6	47.0	49.7	-4.5
High-risk condition¶					
Yes	602	36.3	37.4	52.4	-5.8
No	1,058	63.7	62.6	43.8	-1.9
Vaccinated for previous influenza season					
Yes	691	41.7	39.8	86.5	3.0
No	968	58.4	60.2	20.7	-0.2
Provider recommendation/Offer					
Recommended and offered	744	44.8	43.7	73.6	2.7
Recommended with no offer	181	10.9	9.9	47.9	15.1
No recommendation and no offer	413	24.9	26.4	11.1	2.6
Unknown status for recommendation and offer	243	14.6	15.0	30.9	1.8
Did not visit a provider since August 2011	79	4.8	5.0	50.5	5.7

* **Source:** CDC. Influenza vaccination coverage among pregnant women—United States, 2010–11 influenza season. MMWR 2011;60:1078–82 .

† Those who were employed for wages and the self-employed were grouped as working. Those who were out of work, homemakers, students, retired, or unable to work were grouped as not working.

§ For those who only reported a range for income, the mid-point of the range was used for the actual household income.

¶ Conditions associated with increased risk for serious medical complications 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.

What is already known on this topic?

Pregnant women are at increased risk for influenza-associated complications and are recommended to receive inactivated influenza vaccination regardless of trimester. Vaccination coverage among pregnant women was estimated at 32% (National 2009 H1N1 Flu Survey) and 47% (Pregnancy Risk Assessment Monitoring System) for the 2009–10 season and 38% (Behavioral Risk Factor Surveillance System) and 49% (Internet panel survey) for the 2010–11 influenza season.

What is added by this report?

Approximately 47% of pregnant women in the Internet panel survey reported being vaccinated for influenza for the 2011–12 influenza season; 9.9% were vaccinated before pregnancy; 36.5% during pregnancy; and <1.0% after pregnancy. Women who received both health-care provider recommendations and offers to vaccinate had substantially higher vaccination coverage (73.6%) compared with other women (47.9% for those with recommendations but no offers, and 11.1% for those with neither).

What are the implications for public health practice?

Continued efforts are needed to encourage health-care providers to educate their patients about the safety and effectiveness of vaccination and continually recommend and offer influenza vaccination to their pregnant patients. To overcome their concerns and fears, messages to pregnant women should emphasize the safety and effectiveness of maternal influenza vaccination for both the mother and baby.

health-care provider recommendation and offer for influenza vaccination, 73.6% received influenza vaccination, which was substantially higher than for women whose health-care provider recommended but did not offer vaccination (47.9%) and for women who did not receive either a provider recommendation or offer (11.1%) (Table 1).

Among the 87.7% of women participants who indicated that they had visited a provider since August 2011, 62.9% received a provider recommendation for influenza vaccination (Table 2).Within each of the categories, the subgroups with lower percentages reporting receipt of a provider recommendation were non-Hispanic black (54.1%), having no medical insurance (46.4%), underweight before pregnancy (55.0%), not vaccinated for the previous season (48.6%), and visited a provider because of pregnancy five times or fewer (52.3%) (Table 2). The subgroups with a higher percentage receiving a provider recommendation were women with more than a college degree (71.9%), women who were vaccinated for the previous season (83.7%), and those with more than 10 pregnancy-related provider visits (76.0%) (Table 2).

Most women who received influenza vaccination received it at their obstetrician's or midwife's office (41.4%), at a non-obstetrician health-care provider's office (20.7%), or a hospital, clinic or health center (17.5%). Other locations for vaccination included pharmacy/drug or grocery store (8.0%); health department (4.1%); and workplace, school, or others (8.3%).

Among unvaccinated women who received a health-care provider recommendation and offer of vaccination, when the main reason for nonvaccination was asked, the top three most common answers were 1) concern that the vaccination would cause influenza (25.6%); 2) concern about the safety risk to the baby (13.1%); and 3) not believing the vaccination was effective (12.5%) (Table 3). Among women reporting no provider offer for influenza vaccination, the same three answers for not being vaccinated were most frequently cited (Table 3).

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Editorial Note

In previous years, estimates of annual influenza vaccination levels among pregnant women were consistently lower than 30% through the 2007–08 season, according to data from the National Health Interview Survey (*4*) and Behavioral Risk Factor Surveillance System (BRFSS) (*5*). During the 2009–10 influenza A (H1N1) pdm09 season, estimates increased to 32% (National 2009 H1N1 Flu Survey) (*6*) and 47% (Pregnancy Risk Assessment Monitoring System) (*5*). During the 2010–11 influenza season, estimates were 38%, according to BRFSS data (*5*) and 49%, based on the previous Internet panel survey (*3*). The findings in this report indicate that the level of influenza vaccination among pregnant women achieved during the two preceding seasons (*3*) was sustained during the 2011–12 season.

Women who received a health-care provider recommendation for influenza vaccination continued to be more likely to be vaccinated (*5,6*); in addition, women who received both a provider recommendation and an offer for influenza vaccination were more likely to be vaccinated than women who only received a provider recommendation. In this study, 81.6% of women with a recommendation to be vaccinated were offered vaccination during a visit with their provider. Among women

TABLE 2. Percentage vaccinated among women pregnant at any time during October 2011–January 2012 who reported at least one visit to a health-care provider since August 2011, by health-care provider recommendation and offer status* and selected characteristics — Internet panel survey, United States, 2011–12 influenza season

	Received health-care provider recommendation		% vaccinated					
			Recommended and offered		Recommended with no offer		No recommendation	
Characteristic	**No.**	**%†**	**No.**	**%†**	**No.**	**%†**	**No.**	**%†**
Total	**1,356**	**62.9**	**693**	**73.8**	**167**	**48.5**	**380**	**11.0**
Age group (yrs)								
18–24	329	56.6	162	70.5	—§	—	107	6.1
25–49	1,027	65.9	531	75.2	138	52.1	273	14.0
Race/Ethnicity								
Hispanic	186	61.8	96	76.8	—	—	57	11.8
White, non-Hispanic	986	65.1	505	74.1	128	48.2	265	12.0
Black, non-Hispanic	94	54.1	44	66.3	—	—	36	8.1
Other, non-Hispanic	90	69.4	48	77.0	—	—	—	—
Education								
Less than college degree	654	61.0	329	71.7	74	40.1	197	7.8
College degree only	510	62.4	267	74.4	60	50.1	137	14.5
More than college degree	172	71.9	87	79.5	31	68.1	43	16.3
Married								
Yes	982	64.3	509	75.1	124	51.1	262	11.7
No	374	60.0	184	71.1	43	42.5	118	9.7
Medical coverage								
Any public	428	63.2	227	72.9	52	38.1	122	9.9
Private/Military only	858	64.2	440	75.1	108	56.2	230	12.1
None reported	70	46.4	—	—	—	—	—	—
Working status¶								
Working	735	63.0	335	75.8	93	52.6	191	12.4
Not working	721	62.7	358	72.0	74	43.2	189	9.7
Poverty status**								
Below poverty	264	59.9	130	74.2	32	22.5	74	7.3
At or above poverty	1,064	63.5	547	74.0	131	57.5	299	12.4
Pre-pregnancy weight††								
Underweight	76	55.0	36	66.6	—	—	—	—
Normal weight	734	61.5	365	73.4	98	41.7	198	9.8
Overweight	242	67.8	128	70.0	32	63.3	65	5.6
Obese	267	64.0	144	78.1		N/A	80	15.5
High-risk conditions§§								
Yes	492	67.6	273	76.8	55	52.9	125	11.6
No	864	60.0	420	71.6	112	46.1	255	10.7
Vaccinated for previous season								
Yes	581	83.7	410	94.7	70	89.5	71	51.2
No	774	48.6	283	45.7	97	20.8	309	2.4
No. of provider visits related to pregnancy								
≤5 visits	487	52.3	205	70.7	52	43.7	180	7.8
6–10 visits	530	64.4	272	72.9	74	48.8	137	13.4
>10 visits	288	76.0	182	79.0	35	49.5	53	18.5

* The women were asked two questions: "Since August 2011, during your visits to the doctor/medical professional, did your doctor or other health professional personally recommend that you get a flu vaccination?" and "Since August 2011, during your visits to the doctor/medical professional, did your doctor or other health professional offer the flu vaccination to you?" A total of 243 women with unknown response regarding provider recommendation and offer were excluded.

† Weighted percentage.

§ Sample size <30.

¶ Those who were employed for wages and the self-employed were grouped as working. Those who were out of work, homemakers, students, retired, or unable to work were grouped as not working.

** Below poverty was defined as a total family income of <$22,811 for a family of four with two minors as of 2011, as categorized by the U.S. Census Bureau (http://www.census.gov/hhes/www/poverty/data/threshld/index.html). For those who only reported a range for income, the mid-point of the range was used for the actual household income.

†† Based on body mass index (weight [kg] / height [m]^2). Underweight = <8.5; normal weight = 18.5–24.9; overweight = 25–29.9; obese = ≥30.0.

§§ Conditions associated with increased risk for serious medical complications 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.

TABLE 3. Main reasons offered for not receiving influenza vaccination among nonvaccinated women pregnant at any time during October 2011–January 2012*, by health-care provider recommendation and offer status — Internet panel survey, United States, 2011–12 influenza season

	Total		Recommendation and offer†		No offer†	
Reason	No.	%§	No.	%	No.	%
Total	**815**	**100**	**179**	**28**	**434**	**72**
Concerned vaccination would give me the flu	**145**	**20.0**	43	25.6	70	18.3
Concerned about the safety risk to my baby	**131**	**15.8**	26	13.1	72	17.1
Don't think the vaccination is effective in preventing flu	**93**	**10.7**	21	12.5	53	11.2
Do not need the vaccination	**66**	**8.4**	12	7.8	36	8.8
The flu will not make me very sick/can get medication to treat	**61**	**7.6**	5	3.0	41	9.0
Concerned about the safety risks to myself	**52**	**5.5**	16	6.4	21	4.3
Afraid of needle/shots	**38**	**5.4**	13	10.6	14	3.3
Concerned about side effects	**39**	**5.2**	2	1.7	22	4.9
Don't trust it	**43**	**4.6**	11	5.6	25	4.9
Not covered by medical insurance/costs too much	**35**	**4.3**	7	2.5	19	5.4
Don't have time/don't know where to go/who to call	**31**	**3.7**	5	3.2	20	4.5
Allergic/contraindication	**22**	**2.4**	6	2.5	6	1.6
Other reason	**59**	**6.4**	12	5.5	35	6.7

* Main reason data were missing for 43 women.
† The women were asked two questions: "Since August 2011, during your visits to the doctor/medical professional, did your doctor or other health professional personally recommend that you get a flu vaccination?" and "Since August 2011, during your visits to the doctor /medical professional, did your doctor or other health professional offer the flu vaccination to you?" Data regarding provider recommendation and offer were missing for 202 women.
§ Weighted percentage.

in this group, vaccination coverage was 73.6%, nearly reaching the *Healthy People 2020* target of 80% for pregnant women, regardless of provider recommendations or offers.¶

Studies of health-care providers have suggested that they are more likely to discuss influenza vaccination with their patients when they understand the vaccination guidelines for pregnant women, are vaccinated themselves, or provide vaccination at their practice (*7–8*). However, providers also might be more likely to recommend influenza vaccination to women who appear to be in favor of influenza vaccination. A previous study found that providers' who did not recommend vaccination were more likely influenced by patient preference than the providers' continuing education (*9*).

Even among the 288 women in the sample with more than 10 pregnancy-related provider visits, about one fourth reported they did not receive a provider recommendation for influenza vaccination. Providers might have administrative and financial barriers to routine offering of influenza vaccination, such as working in a solo practice, concern about the up-front cost of ordering vaccines, high costs of storing and maintaining vaccine inventory, and other logistical challenges of vaccine administration (*10*). In this study, women without medical insurance of any type or with less frequent provider visits related to pregnancy were less likely to receive a provider recommendation. Health-care providers should use every opportunity to recommend and offer vaccination if appropriate, and women who are pregnant or who might become pregnant should ask about influenza vaccination at their provider visits, and if necessary, make a visit just for influenza vaccination.

Among unvaccinated women, 25.6% who received a provider offer and recommendation indicated that the main reason they chose not to receive an influenza vaccination was concern that the vaccination would give them influenza; another 13.1% said they were concerned about the safety risk to their baby. Tailored education messages on vaccination safety delivered through multiple means including social media and text messaging might help change negative attitudes and false beliefs about vaccination.

The findings in this report are subject to at least four limitations. First, the survey was self-administered and not validated by medical record review. Second, the results were weighted to the distribution of pregnant women in the U.S. population, but the study sample did not include women without Internet access. Therefore, it might not be a representative sample of pregnant women and findings might not be generalizable to all pregnant women in the United States. Third, estimates might be biased if the selection processes for entry into the Internet panel and a woman's decision to participate in this particular survey were related to receipt of vaccination. Comparing estimates, the Internet panel survey estimates for women pregnant at any time during October–January was 9 percentage points higher than the BRFSS estimate for women who were pregnant at interview during December–February for the 2010–11 influenza season (*5*) and 4 percentage points higher for the

¶ Additional information available at http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=23.

2011–12 season (CDC, unpublished data, 2012). Additional comparisons with BRFSS and other available data sources over multiple seasons are needed to determine whether the more timely Internet panel survey estimates, despite sampling differences, provide valid assessments of trends. Finally, the results from these surveys might be subject to multiple sources of error, including but not limited to sampling error, coverage error, and measurement error.

Health-care provider recommendation and offer of influenza vaccination were associated with higher vaccination levels among pregnant women. Efforts to enhance provider practices are needed. Messages to pregnant women from providers should more strongly emphasize the safety and effectiveness of maternal influenza vaccination and the risk from influenza to mother and infants without maternal vaccination. Increasing knowledge among pregnant women regarding influenza risks and influenza vaccination safety might also increase opportunities for provider recommendations and offers to vaccinate.

Acknowledgments

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Influenza A (H3N2) Variant Virus-Related Hospitalizations — Ohio, 2012

Since July 2012, 305 cases of infection with influenza A (H3N2) variant (H3N2v) virus containing the influenza A (H1N1)pdm09 M gene have occurred in multiple U.S. states, primarily associated with swine exposure at agricultural fairs (*1*). In Ohio, from July 28 to September 25, 2012, a total of 106 confirmed H3N2v cases were identified through enhanced surveillance. Whereas most H3N2v patients experienced mild, self-limited influenza-like illness (ILI), 11 of the Ohio patients were hospitalized, representing 69% of all H3N2v hospitalizations in the United States. Of these hospitalized H3N2v patients, six were at increased risk for influenza complications because of age or underlying medical conditions, including the only H3N2v-associated fatality reported in the United States to date. This report summarizes the epidemiology and clinical features of the 11 hospitalized H3N2v patients in Ohio. These findings reinforce the recommendation for persons at high risk for influenza complications to avoid swine exposure at agricultural fairs this fall (*2*). In addition, persons not at high risk for influenza complications who wish to reduce their risk for infection with influenza viruses circulating among pigs also should avoid swine and swine barns at agricultural fairs this fall.

Case Finding

In Ohio, testing of upper respiratory specimens was encouraged for patients with ILI (fever ≥100°F [≥37.8°C] with cough or sore throat), and epidemiologic linkages to a confirmed H3N2v case or attendance at an event where confirmed cases were identified (Ohio Department of Health, Health Alert Network: H3N2v information and recommendations, August 2, 2012) (*3*). As part of the epidemiologic investigation, direct swine contact was defined as touching pigs; indirect swine contact was defined as visiting a swine barn at a fair without touching pigs. Respiratory specimens were confirmed as positive for H3N2v virus by testing at the Ohio Department of Health (ODH) laboratory using the CDC FLU real-time reverse transcription polymerase chain reaction (rRT-PCR) Dx Panel for influenza A (H3N2)v and at CDC by rRT-PCR and genetic sequencing (*1*). Information about hospitalized patients was collected using a standard CDC human infection with novel influenza A virus case report form, supplemented by review of medical records.

Case Reports

Patient A. A woman aged 61 years with type 2 diabetes, congestive cardiomyopathy, hypertension, and a past history of B-cell lymphoma, experienced cough and sneezing on August 10 (Table, patient 11). Beginning 6 days earlier, she spent 4 days at a county fair where she visited a swine barn and had direct swine contact. Over the next 2 weeks, she experienced cough and fever and was treated with antibiotics for a sinus infection. On August 25, she sought care at an emergency department with worsening symptoms. The patient was transferred to a tertiary care center with hemodynamic instability and respiratory distress, and required mechanical ventilation. Her condition deteriorated, and she died on August 26. Blood cultures obtained on August 25 yielded *Pseudomonas aeruginosa,* and a nasopharyngeal swab was positive for H3N2v virus by rRT-PCR at ODH. Genetic sequencing of H3N2v virus from a clinical specimen from this patient at CDC was nearly identical to sequencing from several nonfatal H3N2v cases in Ohio, and from H3N2pM* viruses identified among pigs at fairs in Ohio.

Patient B. On August 2, a girl aged 4 years with cough-variant asthma requiring daily inhaled corticosteroids developed fever, 6 days after attending a county fair where she had direct swine contact (Table, patient 6). No close contacts of the patient were ill. The fever resolved after a few days, but diarrhea and cough developed, and the doses of her asthma control medications were increased. On August 11, the diarrhea continued, fever of 101°F (38.3°C) developed, and she was evaluated at an emergency department. Examination revealed dehydration, bilateral otitis media, and normal respiratory function. Chest radiography displayed hyperinflation of the lungs. The girl was treated with intravenous fluids for dehydration and ceftriaxone for otitis media, admitted overnight for hydration, and discharged the following day on amoxicillin. Before discharge, a nasopharyngeal specimen was tested using a commercial respiratory virus PCR panel; results were positive for influenza A (H3) and parainfluenza type 3 viruses. Further testing of a nasopharyngeal specimen was positive for H3N2v virus at ODH and CDC.

Of the 11 hospitalized H3N2v patients, case report forms for seven and hospital records for nine were available. The median age of the patients was 6 years (range: <1 year–61 years), and eight were female (Table). Patients lived in eight counties and attended six fairs. Direct contact with swine prior to illness onset was reported by six patients (five children and one adult), and of these, one patient might have had direct contact with an ill pig. Indirect contact with swine during fair attendance was reported by four patients, including two children aged ≤2

* Infection of swine with H3N2 virus containing the influenza A(H1N1)pdm09 virus M gene is referred to as H3N2pM virus. Infection of humans with this virus is referred to as H3N2v virus.

TABLE. Characteristics of hospitalized patients with confirmed H3N2v virus infection — Ohio, 2012

Patient no.	Age (yrs)	Date(s) of exposure	Date of onset	Type and description of swine exposure	Underlying medical problem	Admission dates and reason	Complications	Imaging or abnormal laboratory findings	Treatment	Day of illness antiviral treatment was started
1*,†	<1	July 30–Aug 5	Aug 5	Indirect contact. Attended a county fair for 6 days while sibling showed pigs, but spent much of time in a stroller in the swine barn. Sibling's pigs normally boarded at family member's house.	None	Aug 7–8; dehydration, influenza A	Dehydration	None	Oseltamivir; IV fluids	2
2*	7	Unknown	Aug 4	Indirect contact. Visited a county fair sometime during the week preceding illness.	Acute lymphocytic leukemia	Aug 6–7; fever, observation	Dehydration	Chest radiograph: normal	Oseltamivir; ceftriaxone	2
3*	12	July 30–Aug 4	Aug 2	Direct contact. Attended county fair for 3 days, involved in transport of swine.	None	Aug 3–4; dehydration, influenza A, bronchitis	Dehydration	Chest radiograph: no infiltrates; serum bicarbonate: 18 mmol/L	Oseltamivir; IV fluids	2
4*,†	1	July 28–Aug 4	Aug 5	Indirect contact. Attended state fair and county fair. Was in stroller in swine barn at state fair. Did not enter swine barn at county fair, but was in stroller and walked in sheep barn which housed several pigs. Was in barn with an ill pig that later died, but without direct swine contact.	None	Aug 7–8; croup	Croup	None	Oseltamivir; croup tent; methylpredniso-lone; IV fluids	3
5*,†	6	Aug 5–11	Aug 12	Direct contact. Attended county fair for 6 days, stayed in camper on fairgrounds; reported petting pigs on Aug 6 and 7.	History of asthma	Aug 13–14; influenza-like illness	Nonpurulent bilateral conjunctivitis	Chest radiograph: no acute process Throat culture: group A beta *Streptococcus*	IV fluids	Not given
6*,†	4	July 26	Aug 2	Direct contact. Attended a county fair for 1 day.	Asthma	Aug 12–13; dehydration	Asthma exacerbation; otitis media	Chest radiograph: hyperinflation, no consolidation or effusion PCR§: parainflu-enza virus type 3	IV fluids; inhaled corticosteroids; albuterol; amoxicillin	Not given
7*,†	5	Aug 3–11	Aug 10	Direct contact. Attended a county fair for 7 days. Siblings were showing swine, which normally stay with another family member. Also had contact with an ill pig, unclear whether this contact was direct or indirect.	None	Aug 11–13; fever with petechiae	Thrombo-cytopenia	No imaging Platelets: 113,000/mm^3	Ceftriaxone; oseltamivir¶	2
8*	5	Aug 4–5	Aug 9	Indirect contact. Visited county fair for 2 days, mother reported child was "playing near pigs."	Genetic syndrome; developmental delay; asthma	Aug 10–12; severe constipation; pneumonia	Pneumonia	Chest radiograph: bronchial airway disease CT pelvis: stool filling colon, large fecal mass in rectal vault	Ceftriaxone; IV fluids; oxygen by nasal cannula; polyethylene glycol electrolyte solution by nasogastric tube	Not given
9†	6	Aug 10–12	Aug 14	Direct contact. Attended county fair for 2 days.	None	Aug 15–16; dehydration	Dehydration	None	Oseltamivir¶	3
10†	6	Unknown	Aug 25	No contact. No attendance at fairs. Saw grandmother on Aug 23, who works with horses on a farm where pigs are also kept. Grandmother had no recent illness. No known illness in pigs.	None	Aug 25–28; urinary tract infection; failed outpatient therapy (Aug 25–28)	None	Unavailable	IV antibiotics**	Not given
11*,†	61	Aug 4–9	Aug 10	Direct contact. Attended county fair for 4 days, spent time in swine barn, at arena, and stayed on fairgrounds in camper. Reported direct pig contact during fair.	Diabetes; cardiomyopathy; hypertension; history of lymphoma	Aug 25–26; atrial fibrillation; respiratory distress; hypoxia	Pneumonia; sepsis; death	Chest CT: bilateral infiltrates; blood culture: *Pseudomonas aeruginosa*	Supportive care in intensive care unit; IV antibiotics**	Not given

Abbreviations: IV = intravenous; PCR = polymerase chain reaction; CT = computed tomography.
* Data gathered from medical chart review.
† Data gathered using novel influenza A case report form.
§ Commercial respiratory virus PCR panel.
¶ Oseltamivir therapy discontinued after 1 day because of vomiting.
** Antibiotic unknown.

years who were in strollers in swine areas, and two children with serious underlying medical conditions. Of the four children who reported indirect exposure to swine, exposure was reported to be ≥2 days for three. One child did not attend a fair, but had contact with a person who was exposed to pigs.

Among the 11 hospitalized H3N2v patients, six were considered at high risk for complications from influenza, because of age <5 years (three) or underlying medical conditions (two children, one adult). All 11 experienced fever, nine had cough, and seven had vomiting or diarrhea. One patient was admitted for an unrelated medical problem and tested for respiratory viruses because of prolonged fever and a new cough. Dehydration was the most common reason for admission. Two children were admitted for observation because of fever: one with acute lymphocytic leukemia and one with a petechial rash. Only one patient had received antiviral treatment before admission, four patients received oseltamivir treatment within 48 hours of illness onset, and six were treated with oseltamivir during hospitalization, but two were treated only for 1 day. Only one child required supplemental oxygen, and another was treated with humidified air. Patient A, who subsequently died, was the only patient requiring mechanical ventilation. Median length of hospital stay was 1 day (range: 1–3 days).

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Editorial Note

Of the hospitalized H3N2v patients described in this report, 10 of 11 were children, and six of 11 were considered at high risk for influenza complications because they were aged <5 years or had underlying medical conditions. All hospitalizations were brief and severe illness was observed only in the patient who died. Six patients reported direct contact with pigs at agricultural fairs. Among four patients with indirect swine exposure at fairs, three reported ≥2 days of fair attendance. One patient had no reported swine exposure. These findings support current recommendations that persons at high risk for influenza complications, including children aged <5 years and persons with chronic underlying medical conditions that confer high risk for severe complications from influenza, should avoid the swine barn and pens when attending agricultural fairs. (*2*).

Clinicians should be aware that rapid influenza diagnostic tests might not detect H3N2v virus (*4*). Specific H3N2v virus testing is available only at state public health laboratories and CDC. In two instances, rRT-PCR testing for H3N2v was positive after ≥10 days of illness in patients who were not immunosuppressed and did not receive antiviral treatment. Both patients had documented infection with other pathogens (*P. aeruginosa* in patient A and parainfluenza virus type 3 in patient B). Although *P. aeruginosa* bacteremia undoubtedly contributed to patient A's death, the role of parainfluenza virus infection in patient B's illness is unknown.

Of the six patients at high risk for influenza complications, two received antiviral treatment within 2 days after illness onset, while five of 11 patients were not treated at any time during their hospitalization. Clinicians should be aware that starting empiric antiviral treatment for 5 days with oral oseltamivir or inhaled zanamivir as soon as possible after onset of symptoms is recommended for any hospitalized patient with suspected influenza, including H3N2v, without waiting for

What is already known on this topic?

Beginning in the summer of 2012, CDC reported increases in numbers of cases of human infections with influenza A (H3N2) variant (H3N2v) viruses associated with swine exposure at agricultural fairs. Nationwide, 305 cases, 16 hospitalizations, and one death across 10 states have been reported since July 2012.

What is added by this report?

Of 16 patients hospitalized with confirmed H3N2v virus infection, 11 were Ohio residents, including the only H3N2v-associated fatality to date. All but one of the Ohio patients were children, and six were considered high-risk for complications of influenza because they were aged <5 years or had underlying medical conditions; four high-risk persons became ill after indirect contact with pigs. These findings support current CDC recommendations that persons at high risk for complications of influenza should avoid exposure to swine at agricultural fairs this fall.

What are the implications for public health practice?

County and state fairs in the United States continue to occur through the month of October, highlighting the potential for continued cases of H3N2v virus infection. Persons at high risk for complications of influenza should avoid exposure to swine at agricultural fairs. Patients with suspected influenza, including H3N2v, who are hospitalized or at increased risk for influenza complications, should receive antiviral treatment with oral oseltamivir or inhaled zanamivir as soon as possible. Antiviral treatment also is encouraged for outpatients with suspected H3N2v who are not at increased risk for influenza complications.

testing results (*2,5*). Beginning antiviral treatment as soon as possible also is recommended for outpatients with suspected influenza who are at high risk for influenza complications (*2,5*). Five H3N2v patients reported here were not in a high risk group, highlighting the fact that H3N2v virus infection can cause illness resulting in hospitalization, even in otherwise healthy persons. The current interim recommendations from CDC also encourage early antiviral treatment of non-high–risk outpatients with suspected H3N2v virus infection (*2*).

Public health professionals should be aware of the possibility of continued outbreaks of H3N2v virus related to agricultural fairs where swine are present. Pigs with influenza virus infection might be present at agricultural fairs, and swine might be asymptomatically infected with H3N2 or other influenza A viruses (*6,7*). Limited serologic studies indicate that children aged <10 years lack cross-protective antibodies to H3N2v virus (*8*). Persons, especially young children, might be infected with influenza viruses through direct or indirect swine exposure (*9*). Recommendations for preventing swine-to-human transmission of influenza viruses among the general population include staying away from pigs that appear ill (e.g., are coughing or sneezing, off feed, or lethargic) and washing hands with soap and water after contact with swine. Persons at high risk for influenza complications because of age (<5 years or ≥65 years) or underlying medical conditions should avoid swine and swine barns at agricultural fairs this fall. Persons not at high risk for influenza complications who wish to reduce their risk for infection with influenza viruses circulating among pigs also should avoid swine and swine barns at fairs this fall. Continued close communication and collaboration between human and animal health agencies for ongoing surveillance and investigation of influenza viruses among pigs and humans is needed to help guide and potentially expand measures to reduce the public health risk of H3N2v and related viruses.

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Postvaccination Serologic Testing Results for Infants Aged ≤24 Months Exposed to Hepatitis B Virus at Birth — United States, 2008–2011

An estimated 25,000 infants are born to hepatitis B surface antigen (HBsAg)-positive women annually in the United States (*1*). With no intervention, 40%–90% of these infants will acquire hepatitis B virus (HBV) infection (*2,3*). Approximately 90% of infected infants develop chronic HBV infection, with a 15%–25% risk for premature death from cirrhosis or cancer of the liver (*4*). To prevent perinatal HBV transmission, the Advisory Committee on Immunization Practices (ACIP) recommends that infants born to HBsAg-positive women receive postexposure prophylaxis with hepatitis B vaccine (HepB) and hepatitis B immune globulin (HBIG) within 12 hours of birth, and complete the 3-dose HepB series. To determine infant outcomes after postexposure prophylaxis, ACIP recommends postvaccination serologic testing (PVST) at age 9–18 months (*4*). To evaluate the implementation of these recommendations, CDC assessed outcomes at age 24 months (through 2011) among infants born to HBsAg-positive women enrolled during 2008–2009 in Enhanced Perinatal Hepatitis B Case Management Projects (EPHBP). Of 4,214 EPHBP-managed infants who completed ≥3 HepB doses, 63.7% had reported PVST results, 13.3% had reported PVST results but infant age was unknown, and 23.0% had no reported PVST results. Of 2,683 infants with PVST results by age 24 months, 93.3% were protected, 1.2% were infected, 3.2% remained susceptible, and 2.3% had indeterminate results. ACIP-recommended postexposure prophylaxis was highly effective among infants who completed vaccination and received PVST. PVST is critical for guiding medical management of infants born to HBsAg-positive women, identifying infants with HBV infection and in need of further care, and monitoring progress toward the elimination of perinatal HBV transmission.

In 2007, CDC funded EPHBP to characterize HBsAg-positive pregnant women and assess outcomes among their infants. Five project sites, in Florida, Michigan, Minnesota, New York City, and Texas (excluding cities of Houston and San Antonio), collected and reported data to CDC. Data of women enrolled in EPHBP during 2008–2009 were reviewed; maternal characteristics from the first pregnancy on record were used. Records of all infants born to these women were reviewed to age 24 months; PVST records were examined for infants who completed ≥3 HepB doses (with and without HBIG). Of infants with reported PVST results and date, HBV serology status was categorized as "protected" (anti-HBs-positive, HBsAg-negative), "HBV-infected" (anti-HBs-negative, HBsAg-positive; anti-HBs-positive, HBsAg-positive; or anti-HBs unreported, HBsAg-positive), "susceptible" (anti-HBs-negative, HBsAg-negative), or "indeterminate" (all other result combinations). A protective anti-HBs result was defined as ≥10 mIU/mL. Records of susceptible infants were reviewed for revaccination and repeat PVST. Bivariate analysis of mother/infant pairs was used to examine associations between maternal characteristics (age, race/ethnicity, place of birth, primary language) and infant outcomes (≥3 HepB doses, PVST receipt); significant variables were evaluated further in a multivariable logistic regression model.

EPHBP managed 5,075 infants born to 4,938 HBsAg-positive women in 2008–2009. Most of the women were aged 20–39 years, self-identified as Asian/Pacific Islander (API) or non-Hispanic black, were foreign-born, and almost half indicated a primary language other than English (Table 1). Maternal characteristics were not significantly associated with infant receipt of ≥3 HepB doses. Infants born to women who were Hispanic (odds ratio [OR] = 0.43; 95% confidence interval [CI] = 0.31–0.61), U.S.-born (OR = 0.60; CI = 0.47–0.75), or whose primary language was English (OR = 0.66; CI = 0.56–0.78) were significantly less likely to receive PVST compared to infants born to women who were non-Hispanic, foreign-born, and whose primary language was non-English, respectively. Infants born to API women (OR = 1.50; CI = 1.29–1.74) were significantly more likely to receive PVST compared to infants born to non-API women. After controlling for maternal place of birth (U.S.-born versus foreign-born) and primary language (English versus non-English), infants born to API women were slightly more likely to receive PVST than infants of non-API women (OR = 1.09, $p<0.001$).

By age 24 months, 4,214 EPHBP-managed infants received ≥3 HepB doses (Table 2). Although 3,244 (77.0%) of these infants received PVST, 412 (9.8%) received incomplete PVST, either anti-HBs only (41) or HBsAg only (371). Among the 4,214 EPHBP-managed infants, 2,073 (49.1%) were tested at age 9–18 months; 259 (6.2%) were tested before age 9 months and 351 (8.4%) were tested after age 18 months. Age at testing was unknown (not reported) for 561 (13.3%) infants. Most (355) incomplete results were from one site where infants were tested only for HBsAg and test dates were not reported (Table 3).

Of the 2,683 infants with reported PVST dates and results, 114 remained susceptible after initial vaccination and PVST. Of these infants, 29 received three additional HepB doses and

TABLE 1. Characteristics of hepatitis B surface antigen-positive pregnant women (N = 4,938) — Enhanced Perinatal Case Management Project, Florida, Michigan, Minnesota, New York City, and Texas, 2008–2011

Characteristic	No.	(%)
Age		
≤19 yrs	146	(3.0)
20–29 yrs	2,464	(49.9)
30–39 yrs	2,153	(43.6)
≥40 yrs	175	(3.5)
Race/Ethnicity		
Asian/Pacific Islander	2,961	(60.0)
Black, non-Hispanic	1,195	(24.2)
White, non-Hispanic	367	(7.4)
Hispanic	168	(3.4)
Other*	53	(1.1)
Not reported	194	(3.9)
Place of birth		
U.S.-born	453	(9.2)
Foreign-born	3,855	(78.1)
Not reported	630	(12.7)
Primary language		
English	1,539	(31.2)
Non-English	2,280	(46.2)
Not reported	1,119	(22.6)

* Defined as Alaska Native/Native American or multiracial.

TABLE 2. Vaccination status of infants born to HBsAg-positive pregnant women, at age 24 months (N = 5,075) — Enhanced Perinatal Case Management Project, Florida, Michigan, Minnesota, New York City, and Texas, 2008–2011

Vaccination status	No.	(%)
Completed ≥3 HepB doses	4,214	(83.0)
HBIG, ≥3 HepB doses	4,173	(82.2)
No HBIG, ≥3 HepB doses	41	(0.8)
Incomplete vaccination (lost to follow-up)	861	(17.0)
HBIG, 2 HepB doses	728	(14.3)
No HBIG, 2 HepB doses	5	(0.1)
HBIG, 1 HepB dose	111	(2.2)
No HBIG, 1 HepB dose	15	(0.3)
HBIG, no HepB doses	2	(<0.1)

Abbreviations: HBsAg = hepatitis B surface antigen; HBIG = hepatitis B immune globulin; HepB = hepatitis B vaccine.

repeat PVST, as recommended by ACIP; 27 were protected and two remained susceptible. Overall, 93.3% of tested infants were protected, 1.2% were infected, 3.2% remained susceptible, and 2.3% had indeterminate results (Table 4).

Reported by

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TABLE 3. Postvaccination serologic testing (PVST) among infants who received ≥3 doses of HepB by age 24 months (N = 4,214) — Enhanced Perinatal Case Management Project, Florida, Michigan, Minnesota, New York City, and Texas, 2008–2011

PVST status	No.	(%)
Reported serologic markers tested	3,244	(77.0)
Anti-HBs and HBsAg*	2,832	(67.2)
Anti-HBs only	41	(1.0)
HBsAg only	371	(8.8)
Reported serologic testing (by age)	2,683	(63.7)
<9 mos	259	(6.2)
9–12 mos	1,204	(28.5)
13–18 mos	869	(20.6)
≥19 mos	351	(8.4)
Unknown†	561	(13.3)
No reported PVST	970	(23.0)

Abbreviations: HepB = hepatitis B vaccine; anti-HBs = hepatitis B surface antigen antibody; HBsAg = hepatitis B surface antigen.
* If infant received testing for HBsAg and anti-HBs on different dates, the later test date was used.
† Age at testing could not be calculated because test dates were not reported.

TABLE 4. Serologic outcomes of infants with reported PVST results, by age 24 months (N = 2,683)* — Enhanced Perinatal Case Management Project, Florida, Michigan, Minnesota, New York City, and Texas, 2008–2011

Serologic outcome	No.	(%)
Protected	2,504	(93.3)
Anti-HBs-positive,† HBsAg-negative	2,504	(93.3)
HBV-infected	32	(1.2)
Anti-HBs-negative, HBsAg-positive	28	(1.0)
Anti-HBs-positive, HBsAg-positive	2	(<0.1)
Anti-HBs,§ HBsAg-positive	2	(<0.1)
Susceptible	87	(3.2)
Anti-HBs-negative, HBsAg-negative	87	(3.2)
Indeterminate	60	(2.3)
Anti-HBs-positive, HBsAg§	36	(1.3)
Anti-HBs-negative, HBsAg§	1	(<0.1)
Anti-HBs, § HBsAg-negative	18	(0.7)
Anti-HBs, § HBsAg§	5	(0.2)

Abbreviations: PVST = postvaccination serologic testing; anti-HBs = hepatitis B surface antigen antibody; HBsAg = hepatitis B surface antigen.
* Infant PVST outcome was excluded if test date was not reported (n = 561).
† Defined as titer result ≥10 mIU/mL.
§ Serologic test result not reported.

Editorial Note

ACIP-recommended postexposure prophylaxis for infants born to HBsAg-positive mothers protects 85%–95% of infants from perinatally acquired HBV infection (*4*). Since 1990, CDC has funded perinatal hepatitis B prevention programs to identify HBsAg-positive pregnant women and ensure that their infants receive postexposure prophylaxis, including PVST. PVST identifies infants who are protected, remain susceptible

after a primary HepB series, or develop HBV infection and should be referred for continuing medical care (*4–6*).

Among infants born to HBsAg-positive mothers and managed by perinatal hepatitis B prevention programs in the United States, and who received ≥3 HepB doses, PVST rates by age 15–27 months increased from 25% in 1994 to 56% in 2008 (*1*). In another study, 57% of infants born to HBsAg-positive mothers during 2003–2005 received HBsAg testing (*7*). In comparison, 77.0% of EPHBP-managed infants received PVST, and 63.7% had known serologic outcomes (Table 3). Although rates of PVST have increased, this analysis highlights areas in need of improvement. Strategies are needed to increase the rates for overall testing and testing for both anti-HBs and HBsAg, which are required to confirm outcomes. Of infants in EPHBP, 9.8% received only one of the two recommended serologic tests. An anti-HBs result <10 mIU/mL is insufficient to determine whether the infant is susceptible or is HBV-infected. Alone, an anti-HBs result ≥10 mIU/mL does not confirm that the infant is protected; the HBsAg result also must be negative. A negative HBsAg test result by itself does not indicate whether the infant is protected by vaccination or remains susceptible.

ACIP recommends PVST at age 9–18 months (*4*). Infants should be tested starting at age 9 months, if at least 1 month has passed since the last HepB dose, to ensure that all HBV-infected infants are identified* (*4,8*). Of EPHBP-managed infants, 14.6% received PVST outside of the recommended time frame, and 13.3% had an unknown age at testing. Infants who remain susceptible after an initial HepB series without timely PVST to prompt revaccination have continuing risk for transmission from household contacts with chronic HBV infection. Intervals ≥4 months between the final HepB dose and PVST have been associated with waning of anti-HBs titers, which might fail to confirm protection and result in unnecessary revaccination (*6,9*).

In this analysis, infants born to API women were significantly more likely to receive PVST. Previous studies have yielded mixed results (*5,6,10*). A study examining data from 1992–2000 found that infants whose mothers were non-Hispanic white, were aged <20 years, were U.S.-born, or had a household income <$15,000 were less likely to receive PVST (*6,10*). In another study, however, PVST did not differ significantly by maternal age or race among infants managed by the Louisiana Office of Public Health (*5*).

The results of this study are subject to at least two limitations. First, results from the EPHBP sites might not be representative of all births to HBsAg-positive women in the United States; EPHBP-managed women and infants comprise about 25% of CDC's estimated births to HBsAg-positive women. Second, the completeness of reporting PVST results to CDC was not examined. However, overall PVST rates of EPHBP-managed infants were high compared with rates reported in other studies (*1,7*).

To achieve optimal prevention of perinatal HBV infection, HBsAg-positive pregnant women must be identified before delivery, and their infants must complete appropriate and timely postexposure prophylaxis. PVST (anti-HBs and HBsAg) as soon as age 9 months and at least 1 month after the last HepB dose has been given determines if infants are susceptible and should be revaccinated and retested, or are infected and require additional medical care. Although universal recommendations for HepB vaccination have been published (*4*), no universal recommendations for HBV screening of infants or children have been issued. HBV infection usually is asymptomatic, and therefore is unlikely to be detected without testing, until complications arise. Conducting timely PVST and reporting results to public health officials ensures that infants born to HBsAg-positive women receive appropriate follow-up, and is a key element of surveillance to monitor progress toward the elimination of perinatal HBV transmission.

What is already known on this topic?

Infants born to hepatitis B surface antigen-positive women have a 40%–90% chance of acquiring hepatitis B virus (HBV) infection. Infected infants have a 90% risk of chronic HBV infection, which can result in premature death from liver failure or cancer. Postexposure immunoprophylaxis in infancy prevents 85% to 95% of perinatal infections. To determine infant outcomes, including whether infants require additional vaccination for protection, postvaccination serologic testing is recommended 1 month after completing the hepatitis B vaccine series (age 9–18 months).

What is added by this report?

Among infants with reported outcomes, postvaccination serologic testing data from Enhanced Perinatal Hepatitis B Case Management Projects indicated that timely postexposure prophylaxis might be 93% effective in protecting infants from perinatal hepatitis B infection. However, 23.0% of infants had no reported postvaccination serologic testing.

What are the implications for public health practice?

Postvaccination serologic testing (hepatitis B surface antigen [HBsAg] and hepatitis B surface antigen antibody) for infants born to HBsAg-positive women is important to determine appropriate infant medical follow-up. Test results should be reported to perinatal hepatitis B program coordinators who can assist families in assuring infant protection and who monitor progress toward elimination of perinatal hepatitis B virus transmission.

* Infants who complete the HepB series with the *Haemophilus influenza*e type b combination product (COMVAX, Merck & Co.) at age 12–15 months are eligible for PVST 1 month after the last dose (*2*).

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Announcements

Final State-Level 2011–12 Influenza Vaccination Coverage Estimates Available Online

Final state-specific influenza vaccination coverage estimates for the 2011–12 influenza season are now available online at FluVaxView (http://www.cdc.gov/flu/fluvaxview). Included are estimates of the cumulative percentage of persons vaccinated by the end of each month, during August 2011–May 2012, for each state and U.S. Department of Health and Human Services region, and the United States overall.

Analyses were conducted using National Immunization Survey data for children aged 6 months–17 years and Behavioral Risk Factor Surveillance System data for adults aged ≥18 years. Estimates are provided by age group and race/ethnicity. These estimates are presented using an interactive feature at http://www.cdc.gov/flu/professionals/vaccination/reporti1112/reporti/index.htm and complemented by an online summary report at http://www.cdc.gov/flu/professionals/vaccination/coverage_1112estimates.htm.

The data update the national preliminary estimates from the March 2012 National Immunization Survey and National Flu Survey at http://www.cdc.gov/flu/professionals/vaccination/nfs-survey-march2012.htm.

Environmental Microbiology: Control of Foodborne and Waterborne Diseases Course — January 7–12, 2013

CDC and Emory University's Rollins School of Public Health will cosponsor, Environmental Microbiology: Control of Foodborne and Waterborne Diseases, on January 7–12, 2013, at Emory University, Rollins School of Public Health. This 6-day course on the surveillance of foodborne and waterborne diseases is designed for public health practitioners and other students interested in the safety of food and water.

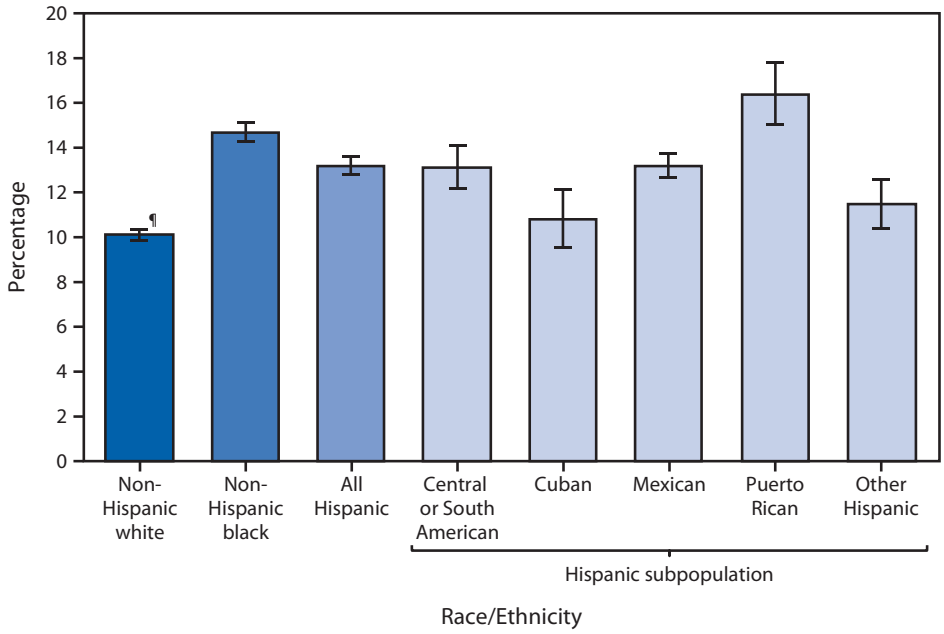
This course will provide a broad overview of the major foodborne and waterborne diseases. The course describes how information from surveillance is used to improve public health policy and practice in ways that contribute to the safety of food and water supplies. Participants will learn about microorganisms and chemical agents responsible for food and water-transmitted diseases, the diseases they cause, the pathogenesis, clinical manifestations, reservoirs, modes of transmission, and surveillance systems. The course also will cover the transport, survival, and fate of pathogens in the environment, the concept of indicator organisms as surrogates for pathogens, and the removal and inactivation of pathogens and indicators by water and wastewater treatment processes. Examples of the public health impact of quality assurance programs, such as Hazard Analysis and Critical Control Points, to control foodborne and waterborne diseases in both industrialized and developing countries will be discussed.

This course is offered to public health professionals and Emory University students. Continuing Education credit is available. Tuition will be charged. The application deadline is December 15, 2012, or until all slots have been filled. Additional information and applications are available from by mail (Emory University, Hubert Department of Global Health [Attn: Pia Valeriano], 1518 Clifton Rd. NE, CNR Bldg., Room 7038, Atlanta, GA 30322); telephone (404-727-3485); fax (404-727-4590); online (http://www.sph.emory.edu/epi-courses), or e-mail (pvaleri@emory.edu).

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged 18–64 years Who Needed Prescription Medicine But Did Not Get it Because of Cost During the Preceding 12 months,* by Black or White Race and Hispanic Subpopulation† — National Health Interview Survey, United States, 2009–2011§



* Based on a survey question that asked respondents, "During the past 12 months, was there any time when you needed (prescription medicine) but didn't get it because you couldn't afford it?" Unknowns were not included in the denominators when calculating percentages.
† Persons of Hispanic ethnicity might be of any race or combination of races. Non-Hispanic persons are those who are not of Hispanic ethnicity, regardless of race.
§ Estimates were based on household interviews of a sample of the U.S. civilian, noninstitutionalized population.
¶ 95% confidence interval.

During 2009–2011, Hispanic adults aged 18–64 years were less likely (13.2%) than non-Hispanic blacks (14.7%) but more likely than non-Hispanic white s (10.1%) to have needed prescription medicine but not gotten it because of cost during the preceding 12 months. Among Hispanic subpopulations, the percentage of Puerto Rican adults needing prescription medicine but not getting it because of cost was higher (16.4%) than for Mexican adults (13.2%), other Hispanic adults (11.5%), and Cuban adults (10.8%), but not significantly different from Central or South American adults (13.1%).

Source: National Health Interview Survey, 2009–2011 Sample Adult Core component. Available at http://www.cdc.gov/nchs/nhis.htm.

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