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Invasive Cancer Incidence — United States, 2009

Cancer is a leading cause of illness and death in the United States, and many cancers are preventable (*1*). Surveillance of cancer incidence can help public health officials target areas for cancer control efforts (*2*) and track progress toward the national cancer objectives set forth in *Healthy People 2020* (*3*). This report summarizes the most recent invasive cancer incidence rates by sex, age, race, ethnicity, primary site, and state of residence using data from U.S. Cancer Statistics (USCS) for 2009. USCS includes incidence data from CDC's National Program of Cancer Registries (NPCR) and the National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) program and mortality data from the National Vital Statistics System (*4*). In 2009, a total of 1,476,504 invasive cancers were diagnosed in the United States, an annual incidence rate of 459 cases per 100,000 persons. Cancer incidence rates were higher among men (524) than women (414), highest among blacks (473) and lowest among American Indian/Alaska Natives (273), and ranged by state from 387 to 509. Populations defined by state of residence, race, or ethnicity with high rates of cancer might benefit most from targeted cancer prevention and control efforts.

Data on new cases of invasive cancer diagnosed during 2009 were obtained from population-based cancer registries affiliated with the NPCR and SEER programs. Invasive cancers are all cancers except in situ cancers (except in the urinary bladder) or basal and squamous cell skin cancers. In each state and the District of Columbia (DC), data about new diagnoses of cancer are collected from patient records at hospitals, physicians' offices, therapeutic radiation facilities, freestanding surgical centers, and pathology laboratories and reported to NPCR or SEER central cancer registries. The central cancer registries collate these data and use state vital records, the Social Security Index, and the National Death Index to collect information about any cancer deaths that were not reported as cases. These data are submitted to CDC or NCI and combined into one dataset by CDC (*4*). Data from all cancer registries met the six USCS publication criteria for 2009.* For this report, however, data from Wisconsin for 2009 were suppressed at that state's request. A central cancer registry may request time for making corrections and may suppress their data for various reasons. With the exclusion of data from Wisconsin, data in this report cover 98% of the U.S. population.

Cases were classified by site using the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3). Breast cancers also were characterized by stage at diagnosis

* Cancer registries demonstrated that cancer incidence data were of high quality by meeting the six USCS publication criteria: 1) case ascertainment is ≥90% complete, 2) ≤5% of cases are ascertained solely on the basis of a death certificate, 3) ≤3% of cases are missing information on sex, 4) ≤3% of cases are missing information on age, 5) ≤5% of cases are missing information on race, and 6) ≥97% of the registry's records passed a set of single-field and inter-field computerized edits that test the validity and logic of data components. Additional information available at http://www.cdc.gov/uscs.

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using SEER Summary Stage 2000[†]; late-stage cancers include those diagnosed at a regional or distant stage.

Race and ethnicity information was abstracted from medical records. Race was categorized as white, black, American Indian/Alaska Native, or Asian/Pacific Islander. Ethnicity was categorized as Hispanic or non-Hispanic.

Postcensal population denominators for incidence rates were race-specific, ethnicity-specific, and sex-specific county population estimates from the 2000 U.S. Census, as modified by SEER and aggregated to the state and national level.[§] Annual incidence rates per 100,000 population were age-adjusted by the direct method to the 2000 U.S. standard population.

In 2009, a total of 1,476,504 invasive cancers were diagnosed and reported to central cancer registries in the United States (excluding Wisconsin), including 757,545 among males and 718,959 among females (Table). The age-adjusted annual incidence for all cancers was 459 per 100,000 population (524 per 100,000 in males and 414 per 100,000 in females). Among persons aged ≤19 years, 14,023 cancer cases were diagnosed in 2009 (Table). By age group, rates per 100,000 population in 2009 were 16.9 among persons aged ≤19 years, 155.5 among those aged 20–49 years, 843.2 among those aged 50–64 years, 1,903.0 among those aged 65–74 years, and 2,223.0 among those aged ≥75 years (Table).

By cancer site, rates were highest for cancers of the prostate (137.7 per 100,000 men), female breast (123.1 per 100,000 women), lung and bronchus (64.3 overall, 78.2 among men and 54.1 among women), and colon and rectum (42.5 overall,

[†] Additional information is available at http://seer.cancer.gov/tools/ssm.

[§] Population estimates for 2009 incorporate bridged single-race estimates that are derived from the original multiple race categories in the U.S. 2000 Census. Additional information is available at http://seer.cancer.gov/popdata/index.html and http://www.census.gov/popest/topics/methodology.

What is already known on this topic?

Cancer is a leading cause of illness and death in the United States, and many cancers are preventable.

What is added by this report?

National cancer surveillance data indicate that 1,476,504 new cases of invasive cancer were diagnosed in the United States in 2009, an annual incidence rate of 524 cases per 100,000 among men and 414 among women. Rates were highest (473 per 100,000 population) among blacks and lowest among American Indian/Alaska Natives (273), largely reflecting differences in rates of cancers of the prostate and female breast. By state, all-sites cancer incidence rates ranged from 387 to 509 per 100,000 population. The *Healthy People 2020* objective for reduced incidence of colorectal cancer was met among women and in some states.

What are the implications for public health practice?

High rates of cancer by race, ethnicity, and state of residence indicate populations that might benefit most from targeted cancer prevention and control efforts. National cancer surveillance data help public health officials track progress toward the national cancer objectives set forth in *Healthy People 2020*.

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TABLE. Number and incidence* of invasive cancers,† by sex, primary sites, racial and ethnic group,§ and age group — National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology, and End Results (SEER) program,¶ United States, 2009

	Overall			Men			Women		
Characteristic	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)
All cancers	**459.0**	**1,476,504**		**523.5**	**757,545**		**414.3**	**718,959**	
Prostate	NA	206,640	(14)	137.7	206,640	(27)	NA	NA	
Female breast	NA	211,731	(14)	NA	NA		123.1	211,731	(29)
Lung and bronchus	64.3	205,974	(14)	78.2	110,190	(15)	54.1	95,784	(13)
Colon and rectum	42.5	136,717	(9)	49.2	70,223	(9)	37.1	66,494	(9)
Racial and ethnic group									
White	456.5	1,244,503	(84)	513.0	636,138	(84)	418.2	608,365	(85)
Black	472.9	156,869	(11)	593.7	81,670	(11)	393.4	75,199	(10)
American Indian/Alaska Native	272.9	6,997	(<1)	294.8	3,427	(<1)	258.3	3,570	(<1)
Asian/Pacific Islander	291.8	39,213	(3)	309.6	17,820	(2)	283.5	21,393	(3)
Hispanic	353.0	102,278	(7)	395.2	50,074	(7)	327.9	52,204	(7)
Age group (yrs)									
≤19	16.9	14,023	(1)	17.7	7,481	(1)	16.2	6,542	(1)
20–49	155.5	192,055	(13)	114.8	71,622	(9)	196.3	120,433	(17)
50–64	843.2	477,087	(32)	924.4	254,091	(34)	768.2	222,996	(31)
65–74	1902.5	385,233	(26)	2368.2	220,684	(29)	1506.3	164,549	(23)
≥75	2223.3	408,106	(28)	2872.4	203,667	(27)	1810.9	204,439	(28)

Abbreviation: NA = not available.
* Age-adjusted to the 2000 U.S. standard population.
† Excludes basal and squamous cell carcinomas of the skin, except when these occur on the skin of the genital organs, and in situ cancers, except urinary bladder.
§ Race categories are not mutually exclusive from Hispanic ethnicity. Rates are not presented for cases with unknown or other race.
¶ Compiled from cancer registries that meet the data-quality criteria for all invasive cancer sites combined (covering approximately 98% of the U.S. population).

49.2 among men and 37.1 among women) (Table). These four sites accounted for half of cancers diagnosed in 2009, including 206,640 prostate cancers, 211,731 female breast cancers, 205,974 lung and bronchus cancers (110,190 among men and 95,784 among women), and 136,717 colon and rectum cancers (70,223 among men and 66,494 among women).

The top 10 cancer sites differed by sex and racial and ethnic group (Figure 1). Among men in 2009, prostate cancer was the most common cancer in all racial and ethnic groups; lung and colorectal cancers were the second and third most common cancers in all racial and ethnic groups, except among Hispanic men, among whom the order was switched. Among women in 2009, breast cancer was the most common cancer among all racial and ethnic groups, followed by lung, colorectal, and uterine cancers in all racial and ethnic groups, except among Hispanic women, among whom colorectal cancer was more common than lung cancer, and Asian/Pacific Islander women, among whom the most common cancers were colorectal, lung, and thyroid (Figure 1). Beyond these cancers, cancer ranking varied by race and ethnicity. Incidence of late-stage breast cancer was highest among black women (Figure 1).

By state in 2009, all-sites cancer incidence rates ranged from 387.1 per 100,000 population to 509.1 (Figure 2). State site-specific cancer incidence rates ranged from 95.2 to 178.4 for prostate cancer, 104.7 to 139.2 for female breast cancer, 28.1 to 96.9 for lung cancer, and 30.8 to 52.8 for colorectal cancer (Figure 2).

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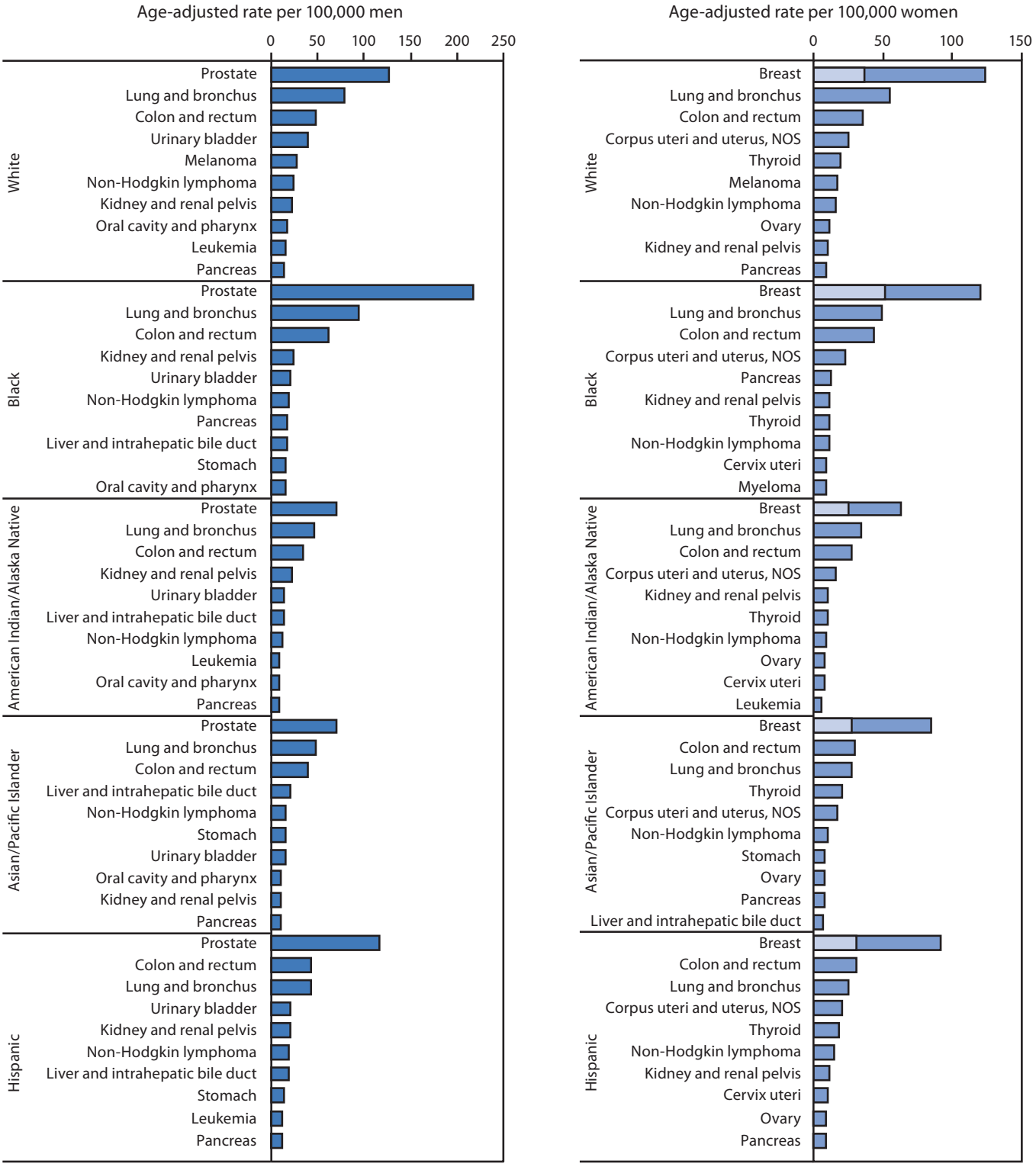
Editorial Note

Twenty years ago, Congress established NPCR by enacting the Cancer Registries Amendment Act (Public Law 102-515) to ensure that state cancer registries are population-based and meet minimum standards of completeness, timeliness, and quality (*5*). This act authorized CDC to provide funds to states and territories to improve existing cancer registries; plan and implement registries where they do not exist; develop model legislation and regulations for states to enhance the viability of registry operations; set standards for data completeness, timeliness, and quality; provide training for registry personnel; and help establish a computerized reporting and data processing system (*5*). Before NPCR was established, 10 states had no cancer registry, and most states with registries lacked the resources and legislative authority needed to gather complete data (*6*). Today, NPCR supports central cancer registries in 45 states, DC, Puerto Rico, and the U.S. Affiliated Pacific Islands.

Healthy People 2020 objectives call for increasing the number of central, population-based registries that capture case information on at least 95% of the expected number of reportable cancers (*3*). In 2011, 42 registries met this objective.

FIGURE 1. Invasive cancer incidence rates* for 10 primary sites† with the highest rates within racial and ethnic groups,§ by sex — National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology, and End Results (SEER) program,¶ United States, 2009



Abbreviation: NOS = not otherwise specified.

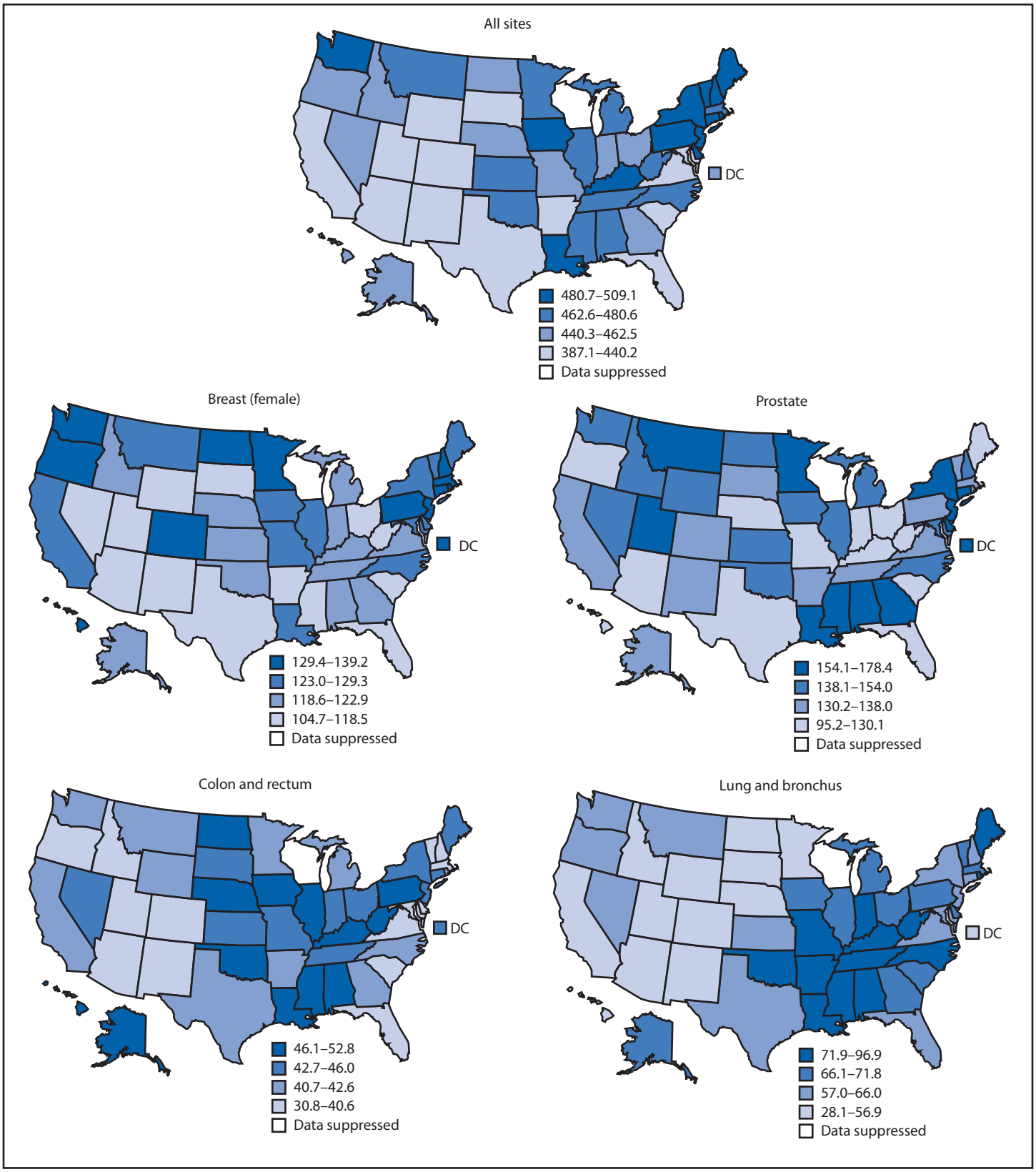
* Rates are age-adjusted to the 2000 U.S. standard population.

† Incidence of late-stage breast cancer is shown as a subset in bar for overall breast cancer incidence.

§ Race categories are not mutually exclusive from Hispanic ethnicity.

¶ Compiled from cancer registries that meet the data-quality criteria for all invasive cancer sites combined, covering approximately 98% of the U.S. population. Excludes basal and squamous cell carcinomas of the skin except when these occur on the skin of the genital organs, and in situ cancers except urinary bladder.

FIGURE 2. Invasive cancer incidence per 100,000 population, by primary cancer site — National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology, and End Results (SEER) program, United States, 2009*



* Age-adjusted to the 2000 U.S. standard population.

Data from population-based central cancer registries are essential for monitoring trends over time and identifying variations in rates by population factors such as age, race, ethnicity, or geographic region. This information can be useful in several ways. First, this information can guide the planning and evaluation of cancer prevention and control programs. The South Carolina Central Cancer Registry, for example, collaborated with comprehensive cancer control staff members and a regional health educator to present county-level information about cancer incidence, risk factors, and screening to the community.[¶] Second, this information can assist long-term planning for adequate cancer diagnostic and treatment services. In Massachusetts, for example, cancer registry data will be used to evaluate the effect of universal health insurance on cancer treatment. Third, this information can help public health officials set priorities for allocating health resources and track progress toward the national goals and objectives regarding cancer set forth in *Healthy People 2020*. To address disparities in breast and cervical cancer in Mississippi, for example, cancer registry data are used to determine areas where interventions are needed most.

Healthy People 2020 objectives call for reducing colorectal cancer incidence to 38.6 per 100,000 population, reducing late-stage breast cancer incidence to 41.0 per 100,000 women, and reducing cervical cancer incidence to 7.1 per 100,000 women (*3*). This report shows that the objective for reduced colorectal cancer incidence has been achieved among women and in some states. To reduce cancer incidence and achieve *Healthy People 2020* targets, evidence-based interventions can be implemented at both the individual level and the population level to reduce cancer risk factors, promote healthy living, and encourage colorectal, breast, and cervical cancer screening.

One of CDC's goals is to provide high quality NPCR data via several data release products each year to public health officials and others for use in public health planning. These products include USCS, CDC WONDER, State Cancer Profiles, and National Center for Health Statistics (NCHS) Research Data Centers.[**] USCS is a joint publication from CDC and NCI in collaboration with the North American Association of Central Cancer Registries and contains the official federal government cancer incidence and mortality statistics for the U.S. population and for individual states. CDC WONDER is an online query system that produces tables, charts, and maps containing age-adjusted and crude rates by demographic variables. State Cancer Profiles brings together data collected from public health surveillance systems, including county-level data from NPCR. Restricted data from NPCR (and other datasets) are available through the Research Data Center hosted by CDC's NCHS.

The findings in this report are subject to at least three limitations. First, postcensal populations for 2009 were estimated from the 2000 U.S. Census by the U.S. Census Bureau; errors in these estimates might increase as time passes after the census, leading to underestimates or overestimates of incidence rates (*7*). Second, analyses based on race and ethnicity might be biased if race and ethnicity were misclassified; efforts were made to ensure that this information was as accurate as possible.[††] Finally, delays in cancer reporting might result in an underestimate of certain cancers; reporting delays are more common for cancers such as melanoma that are diagnosed and treated in nonhospital settings such as physicians' offices (*8*).

Population-based central cancer registries provide cancer incidence surveillance critical to monitoring the cancer burden in the United States. These data can identify populations with high cancer rates that might benefit most from targeted cancer prevention and control efforts. National cancer surveillance data help public health officials track progress toward the national cancer objectives set forth in *Healthy People 2020*.

[¶] Additional information available at http://www.cdc.gov/cancer/npcr/success/index.htm.

[**] Additional information available at http://www.cdc.gov/cancer/npcr/datarelease.htm, http://wonder.cdc.gov/, http://www.statecancerprofiles.cancer.gov/incidencerates/index.php, and http://www.cdc.gov/rdc/b1datatype/dt131.htm.

[††] Additional information available at http://www.cdc.gov/cancer/npcr/uscs/technical_notes/interpreting/race.htm.

Acknowledgment

State and regional cancer registry personnel.

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Interim Adjusted Estimates of Seasonal Influenza Vaccine Effectiveness — United States, February 2013

Early influenza activity during the 2012–13 season (*1*) enabled estimation of the unadjusted effectiveness of the seasonal influenza vaccine (*2*). This report presents updated adjusted estimates based on 2,697 children and adults enrolled in the U.S. Influenza Vaccine Effectiveness (Flu VE) Network during December 3, 2012–January 19, 2013. During this period, overall vaccine effectiveness (VE) (adjusted for age, site, race/ethnicity, self-rated health, and days from illness onset to enrollment) against influenza A and B virus infections associated with medically attended acute respiratory illness was 56%, similar to the earlier interim estimate (62%) (*2*). VE was estimated as 47% against influenza A (H3N2) virus infections and 67% against B virus infections. When stratified by age group, the point estimates for VE against influenza A (H3N2) and B infections were largely consistent across age groups, with the exception that lower VE against influenza A (H3N2) was observed among adults aged ≥65 years. These adjusted VE estimates indicate that vaccination with the 2012–13 influenza season vaccine reduced the risk for outpatient medical visits resulting from influenza by approximately one half to two thirds for most persons, although VE was lower and not statistically significant among older adults. Antiviral medications should be used as recommended for treatment of suspected influenza in certain patients, including those aged ≥65 years, regardless of their influenza vaccination status.

Details of the VE network design, sites, and enrollment procedures have been described previously (*2,3*). In this report, patients aged ≥6 months seeking outpatient medical care for an acute respiratory illness with cough, within 7 days of illness onset, were enrolled at five study sites.* Consenting participants completed an enrollment interview. Nasal and oropharyngeal swabs were combined and tested using CDC's real-time reverse transcription–polymerase chain reaction (rRT-PCR) protocol. Participants were considered vaccinated if they had received ≥1 dose of any seasonal influenza vaccine ≥14 days before illness onset, according to medical records and registries (at Texas, Washington, and Wisconsin sites) or self-report (at Michigan and Pennsylvania sites).

Of the 2,697 children and adults enrolled during December 3, 2012–January 19, 2013, a total of 1,115 (41%) tested positive for influenza virus by rRT-PCR (Figure). The proportion of patients with influenza differed by study site, sex, age group, race/ethnicity, self-rated health status, and interval from illness onset to enrollment (Table 1). The proportion vaccinated ranged from 36% to 54% across sites and also differed by sex, age group, race/ethnicity, and self-rated health status (Table 1).

Among the patients with influenza, 32% had been administered the 2012–13 seasonal influenza vaccine, compared with 50% of the influenza-negative controls (Table 2). For all persons with medically attended acute respiratory illness, the overall VE (adjusted for age group, study site, race/ethnicity, self-rated health status, and days from illness onset to enrollment) against influenza A and B virus infections was 56% (95% confidence interval [CI] = 47%–63%) (Table 2). Significant VE against influenza A and B viruses was observed among persons in all age groups, except for adults aged ≥65 years.

Among the 751 infections with influenza A viruses, 560 (75%) had been subtyped; 546 (98%) of the infections were caused by influenza A (H3N2) viruses (Table 1). The adjusted VE for all ages against influenza A (H3N2) virus infection was 47% (CI = 35%–58%) (Table 2). The adjusted, age-stratified VE point estimates were 58% for persons aged 6 months–17 years, 46% for persons aged 18–49 years, 50% for persons aged 50–64 years, and 9% for persons aged ≥65 years (Table 2).

A total of 366 (33%) of the 1,115 cases had infections caused by influenza B viruses (Table 1). The adjusted VE estimate for all ages against influenza B was 67% (51%–78%) (Table 2). The adjusted VE point estimates against influenza B ranged from 64% to 75% across age groups.

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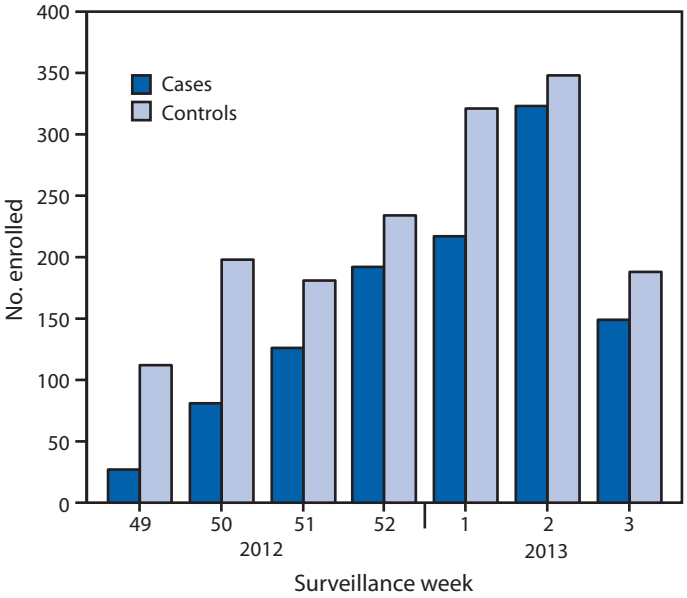
* The five network sites and the dates enrollment began were as follows: Group Health Cooperative (Seattle, Washington) (December 26, 2012); the Marshfield Clinic Research Foundation (Marshfield, Wisconsin) (December 17, 2012); the University of Michigan School of Public Health, partnered with the University of Michigan Health System (Ann Arbor, Michigan) (December 17, 2012) and the Henry Ford Health System (Detroit, Michigan) (January 2, 2013); the University of Pittsburgh Schools of the Health Sciences, partnered with the University of Pittsburgh Medical Center (Pittsburgh, Pennsylvania) (December 3, 2012); and Scott and White Healthcare (Temple, Texas) (December 9, 2012).

FIGURE. Numbers of influenza-positive cases and influenza-negative controls, by surveillance week of illness onset — U.S. Influenza Vaccine Effectiveness Network, United States, December 3, 2012–January 19, 2013



* Week 3 includes only patients with completed laboratory tests and thus does not reflect all enrolled patients during that week across study sites.

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Editorial Note

These updated and age-adjusted VE estimates for the 2012–13 influenza vaccine confirm moderate effectiveness in preventing outpatient medical visits caused by circulating influenza viruses, similar to earlier unadjusted estimates in the United States (*2*) and to recent interim estimates from Canada and Europe (*4,5*). Overall, influenza vaccination reduced the risk for medical visits resulting from influenza A and B by 56%, from influenza A (H3N2) by 47%, and from influenza B by 67%. The preventive benefits against influenza B were consistent across age groups. The adjusted VE estimates against influenza A (H3N2) viruses also were largely consistent (46%–58%) for persons aged 6 months–64 years, but the estimate was not significant among persons aged ≥65 years. These VE estimates are not final; an increased sample size and adjustment for additional potential confounders (such as chronic medical conditions and functional status) at the end of the season could change these estimates.

Confirmation of the protective benefits of the 2012–13 influenza vaccine among persons aged 6 months–64 years offers further support for the public health benefit of annual seasonal influenza vaccination and supports the expansion of vaccination, particularly among younger age groups. The nonsignificant adjusted VE of 9% against A (H3N2) among persons aged ≥65 years is similar to the estimate in a recent interim report from Europe (*6*) and reinforces the need for continued advances in influenza vaccines, especially to increase protective benefits for older adults.

One possible explanation for these findings is that some older adults did not mount an effective immune response to the influenza A (H3N2) component of this season's vaccine. Nonetheless, this finding should not discourage future vaccination by persons aged ≥65 years, who are at greater risk for more severe cases and complications from influenza. Influenza vaccines remain the best preventive tool available, and VE is known to vary by virus type/subtype, age group, season, host immunity, and the outcome measured (*7*). This study observed a VE point estimate against influenza B (67%) that was much higher than the 9% VE estimate against A (H3N2) among older adults, although the precision of estimates was limited by the small sample. Although some previous studies have shown influenza vaccine benefits for older adults, others have failed to demonstrate statistically significant benefits against specific influenza types or subtypes (*7*). Variability among studies and across seasons and age groups is to be expected and should not change recommendations for annual vaccination. It is also important to note that the VE estimates in this report are limited to the prevention of outpatient medical visits, rather than more severe illness outcomes, such as hospitalization or death. A previous multiseason study found that the influenza vaccine reduced the risk for influenza-associated hospitalizations among older adults by 61% (CI = 18%–82%) (*8*). A full evaluation of the VE for older adults this season must await consideration of additional data and outcomes.

TABLE 1. Selected characteristics for enrolled patients with medically attended acute respiratory illness, by infuenza test result status and seasonal influenza vaccination status — U.S. Influenza Vaccine Effectiveness Network,* United States, December 3, 2012–January 19, 2013

	Test result status					Vaccination status		
	Influenza-negative		Influenza-positive			Vaccinated§		
Characteristic	No.	(%)	No.	(%)	p-value†	No./Total	(%)	p-value†
Overall	**1,582**	**(100)**	**1,115**	**(100)**		**1,160/2,697**	**(43)**	
Study site					**<0.001**			**<0.001**
Michigan	257	(16)	138	(12)		**168/395**	(43)	
Pennsylvania	360	(23)	208	(18)		**251/568**	(44)	
Texas	452	(29)	251	(23)		**254/703**	(36)	
Washington	173	(11)	90	(8)		**142/263**	(54)	
Wisconsin	340	(22)	428	(39)		**345/768**	(44)	
Sex					**0.358**			**0.006**
Male	629	(40)	463	(42)		**435/1,092**	(40)	
Female	953	(60)	652	(58)		**725/1,605**	(45)	
Age group (yrs)					**<0.001**			**<0.001**
6 mos–8	379	(24)	261	(23)		**275/640**	(43)	
9–17	186	(12)	202	(18)		**118/388**	(30)	
18–49	604	(38)	353	(32)		**356/957**	(37)	
50–64	248	(16)	174	(16)		**206/422**	(49)	
≥65	165	(10)	125	(11)		**205/290**	(71)	
Race/Ethnicity¶					**0.006**			**0.012**
White	1,191	(75)	885	(80)		**922/2076**	(44)	
Hispanic	154	(10)	94	(8)		**88/248**	(36)	
Black	137	(9)	60	(5)		**72/197**	(37)	
Other race	100	(6)	76	(7)		**78/176**	(44)	
Self-rated health status					**<0.001**			**<0.001**
Fair or poor	138	(9)	68	(6)		**104/206**	(50)	
Good	405	(26)	236	(21)		**297/641**	(46)	
Very good	557	(35)	378	(34)		**424/935**	(45)	
Excellent	482	(30)	433	(39)		**335/915**	(37)	
Illness onset to enrollment (days)					**<0.001**			**0.061**
<3	544	(34)	504	(45)		**441/1,048**	(42)	
3–4	653	(41)	410	(37)		**442/1,063**	(42)	
5–7	385	(24)	201	(18)		**277/586**	(47)	
Influenza test result								
Negative	1,582	(100)	—	—		**793/1,582**	(50)	
Influenza B positive**	—	—	366	(33)		**90/366**	(25)	
Influenza A positive**	—	—	751	(67)		**277/751**	(37)	
A (H1N1)pdm	—	—	14	(2)		**2/14**	(14)	
A (H3N2)	—	—	546	(73)		**211/546**	(39)	
A subtype pending	—	—	191	(15)		**64/191**	(34)	

Abbreviation: rRT-PCR = real-time reverse transcription–polymerase chain reaction.

* The five network sites and the dates enrollment began were as follows: Group Health Cooperative (Seattle, Washington) (December 26, 2012); the Marshfield Clinic Research Foundation (Marshfield, Wisconsin) (December 17, 2012); the University of Michigan School of Public Health, partnered with the University of Michigan Health System (Ann Arbor, Michigan) (December 17, 2012) and the Henry Ford Health System (Detroit, Michigan) (January 2, 2013); the University of Pittsburgh Schools of the Health Sciences, partnered with the University of Pittsburgh Medical Center (Pittsburgh, Pennsylvania) (December 3, 2012); and Scott and White Healthcare (Temple, Texas) (December 9, 2012).

† Chi-square testing was used to assess differences between persons with influenza-negative and influenza-positive test results and in the distribution of enrolled patient and illness characteristics and also to assess differences between groups in the percentage vaccinated.

§ Defined as having received ≥1 dose of vaccine ≥14 days before illness onset. To date, 92% of influenza vaccines administered to participants have been inactivated. A total of 40 participants who received the vaccine ≤13 days before illness onset were excluded from the study sample because of uncertain immunization status.

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

** Two case-patients had coinfections with influenza A and B, making the sum 1,117, or two greater than the total number of influenza positives.

Clinicians should maintain a high index of suspicion for influenza infection among persons with acute respiratory illness while influenza activity is ongoing. Early antiviral treatment can reduce influenza-associated illness severity and complications (*9*); this season, antiviral treatment of elderly adults is especially important.† CDC recommends initiating

† A CDC influenza update for geriatricians and other clinicians caring for persons aged ≥65 years is available at http://www.cdc.gov/flu/professionals/2012-2013-guidance-geriatricians.htm.

TABLE 2. Number and percentage receiving 2012–13 seasonal trivalent influenza vaccine among 2,697 outpatients with acute respiratory illness and cough, by influenza test result status, age group, and vaccine effectiveness* against all influenza A and B and against virus types A (H3N2) and B — U.S. Influenza Vaccine Effectiveness Network,† United States, December 3, 2012–January 19, 2013

	Influenza-positive		Influenza-negative		Vaccine effectiveness			
					Unadjusted		Adjusted	
Influenza type/Age group	No. vaccinated/ Total	(%)	No. vaccinated/ Total	(%)	(%)	(95% CI)	(%)	(95% CI)
Influenza A and B								
Overall	**367/1,115**	**(33)**	**793/1,582**	**(50)**	**(51)**	**(43–58)**	**(56)**	**(47–63)**
Age group (yrs)								
6 mos–17	118/463	(26)	275/565	(49)	(64)	(53–72)	(64)	(51–73)
18–49	100/353	(28)	256/604	(42)	(46)	(29–60)	(52)	(38–79)
50–64	63/174	(36)	143/248	(58)	(58)	(38–72)	(63)	(43–76)
≥65	86/125	(69)	119/165	(72)	(15)	(-42 to 49)	(27)	(-31 to 59)
Influenza A (H3N2) only								
Overall	**211/544**	**(39)**	**793/1,582**	**(50)**	**(37)**	**(23–48)**	**(47)**	**(35–58)**
Age group (yrs)								
6 mos–17	52/179	(29)	275/565	(49)	(57)	(38–70)	(58)	(38–71)
18–49	53/183	(29)	256/604	(42)	(45)	(21–61)	(46)	(20–63)
50–64	41/96	(43)	143/248	(58)	(45)	(12–66)	(50)	(15–71)
≥65	65/86	(76)	119/165	(72)	(-20)	(-118 to 34)	(9)	(-84 to 55)
Influenza B only								
Overall	**90/364**	**(25)**	**793/1,582**	**(47)**	**(67)**	**(58–77)**	**(67)**	**(51–78)**
Age group (yrs)								
6 mos–17	59/230	(26)	275/565	(49)	(64)	(49–74)	(64)	(46–75)
18–49	17/79	(22)	256/604	(42)	(63)	(35–79)	(68)	(40–83)
50–64	8/40	(20)	143/248	(58)	(82)	(59–92)	(75)	(39–90)
≥65	6/15	(40)	119/165	(72)	(74)	(24–91)	(67)	(-10 to 90)

Abbreviation: CI = confidence interval.

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

† The five network sites and the dates enrollment began were as follows: Group Health Cooperative (Seattle, Washington) (December 26, 2012); the Marshfield Clinic Research Foundation (Marshfield, Wisconsin) (December 17, 2012); the University of Michigan School of Public Health, partnered with the University of Michigan Health System (Ann Arbor, Michigan) (December 17, 2012) and the Henry Ford Health System (Detroit, Michigan) (January 2, 2013); the University of Pittsburgh Schools of the Health Sciences, partnered with the University of Pittsburgh Medical Center (Pittsburgh, Pennsylvania) (December 3, 2012), and Scott and White Healthcare (Temple, Texas) (December 9, 2012).

antiviral medications for patients with suspected influenza, regardless of their influenza vaccination status, if they are aged ≥65 years, or hospitalized, or have progressive or complicated illness, or otherwise are at higher risk for complications from influenza.[§] Antiviral treatment can be initiated empirically, preferably within 48 hours after illness onset, and should not be delayed pending confirmatory diagnostic testing nor be dependent upon tests with limited sensitivity (e.g., negative rapid tests). Among hospitalized patients, treatment should be initiated on admission; several studies suggest effectiveness of antiviral treatment even when initiated ≥48 hours after illness onset (*9*).

The findings in this report are subject to at least four limitations. First, the observational study design has greater potential for confounding and bias relative to randomized clinical trials. Second, although these midseason VE estimates were adjusted for potential confounders identified in previous studies (*3*), additional factors will be considered in final end-of-season estimates, including health-care–seeking behavior, differences in functional status, and severity of illness, which could influence VE estimates, especially for older adults. Third, no adjustment was made for chronic medical conditions, because of a lack of medical record data for interim analyses; however, VE estimates were adjusted for self-rated health, which is associated with chronic illness and mortality risk (*10*). Finally, the immunization status of young children (which requires vaccine histories) and vaccine product information (e.g., inactivated compared with live attenuated) also were unavailable for this interim analysis. End-of-season VE estimates could change as additional patient data become available or if circulating viruses or population immunity change over the remainder of the season.

Although imperfect, influenza vaccines remain the best tool currently available for preventing illness from influenza. This report highlights the value of both increasing the use of

[§] Guidance for clinicians on antiviral use is available at http://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm.

What is already known on this topic?

Annual vaccination is the mainstay of influenza prevention, but overall effectiveness of the influenza vaccine is moderate and varies by year, virus type, and population subgroup. Early unadjusted interim estimates of overall vaccine effectiveness (VE) for the 2012–13 season indicated the vaccine was 62% effective among all ages at preventing medically attended, laboratory-confirmed influenza A and B virus infections.

What is added by this report?

This report provides updated and adjusted VE estimates for the 2012–13 influenza season based on data from 2,697 children and adults with acute respiratory illness enrolled in the U.S. Influenza Vaccine Effectiveness (Flu VE) Network during December 3, 2012–January 19, 2013. The overall VE (adjusted for age group, study site, race/ethnicity, self-rated health status, and days from illness onset to enrollment) for all ages at preventing medically attended influenza A and B virus infections was 56% (95% confidence interval = 47%–63%). VE was estimated at 47% against influenza A (H3N2) virus infections and 67% against influenza B virus infections. VE against influenza A (H3N2) was lower and not statistically significant among adults aged ≥65 years.

What are the implications for public health practice?

The 2012–13 seasonal influenza vaccine provides substantial protection for the population overall, which underscores the public health value of vaccination. Nonetheless, some vaccinated persons have become ill with influenza this season, especially among persons aged ≥65 years. Antiviral medications are an important second line of defense against influenza and should be used promptly, as recommended for treatment of suspected influenza in certain patients in high-risk groups, including those aged ≥65 years, regardless of their vaccination status.

influenza vaccines, especially among children and young adults, and continuing efforts to develop more effective vaccines and vaccination strategies. Antiviral medications are important for the treatment and control of influenza and should be used as recommended, regardless of patient vaccination status.

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Update: Influenza Activity — United States, September 30, 2012–February 9, 2013

Influenza activity in the United States began to increase in mid-November and remained elevated through February 9, 2013. During that time, influenza A (H3N2) viruses predominated overall, followed by influenza B viruses. This report summarizes U.S. influenza activity* since the beginning of the 2012–13 influenza season and updates the previous summary (*1*).

Viral Surveillance

During September 30, 2012–February 9, 2013, approximately 140 World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System collaborating laboratories in the United States tested 203,706 respiratory specimens for influenza viruses; 55,470 (27.2%) were positive (Figure 1). Of these, 44,035 (79%) were influenza A viruses, and 11,435 (21%) were influenza B viruses. Of the 44,035 influenza A viruses, 29,914 (68%) were subtyped; 29,091 (97%) of these were influenza A (H3) viruses, and 823 (3%) were influenza A (H1N1)pdm09 (pH1N1) viruses. The percentage of specimens testing positive for influenza increased through the week ending December 29, 2012 (week 52), when 38.1% tested positive, and decreased subsequently. In the week ending February 9, 2013 (week 6), 19.7% of specimens tested positive. Since the start of the influenza season to February 9, 2013, influenza A (H3) viruses predominated in the United States overall, followed by influenza B viruses, while pH1N1 viruses were identified less frequently.

Novel Influenza A Viruses

One infection with an influenza A (H3N2) variant virus (H3N2v) was reported to CDC during the week ending December 8, 2012 (week 49) from Minnesota. Close contact between the patient and swine in the week preceding illness was reported. The patient fully recovered, and no further cases were identified in contacts of the patient. This is the second H3N2v infection reported for the 2012–13 influenza season (*1*).

* The CDC influenza surveillance system collects five categories of information from eight data sources: 1) viral surveillance (U.S. World Health Organization collaborating laboratories, the National Respiratory and Enteric Virus Surveillance System, and novel influenza A virus case reporting); 2) outpatient illness surveillance (U.S. Outpatient Influenza-Like Illness Surveillance Network); 3) mortality (122 Cities Mortality Reporting System and influenza-associated pediatric mortality reports); 4) hospitalizations (FluSurv-NET, which includes the Emerging Infections Program and surveillance in five additional states); and 5) summary of the geographic spread of influenza (state and territorial epidemiologist reports).

Antigenic Characterization

WHO collaborating laboratories in the United States are requested to submit a subset of their influenza-positive respiratory specimens to CDC for further antigenic characterization. CDC has antigenically characterized 1,088 influenza viruses collected during the 2012–13 season, including 86 pH1N1, 677 influenza A (H3N2), and 325 influenza B viruses. All pH1N1 viruses were characterized as A/California/7/2009-like (H1N1), which is the 2012–13 influenza A (H1N1) component of the 2012–13 Northern Hemisphere vaccine. A total of 673 (99.4%) of the 677 influenza A (H3N2) viruses were characterized as A/Victoria/361/2011-like (H3N2), the influenza A (H3N2) component of the 2012–13 Northern Hemisphere vaccine. Of the 325 influenza B viruses tested, 230 (71%) belong to the B/Yamagata lineage and were characterized as B/Wisconsin/1/2010-like, the influenza B component of the 2012–13 Northern Hemisphere vaccine; 95 (29%) of the influenza B viruses tested belong to the B/Victoria lineage of viruses.

Antiviral Resistance of Influenza Virus Isolates

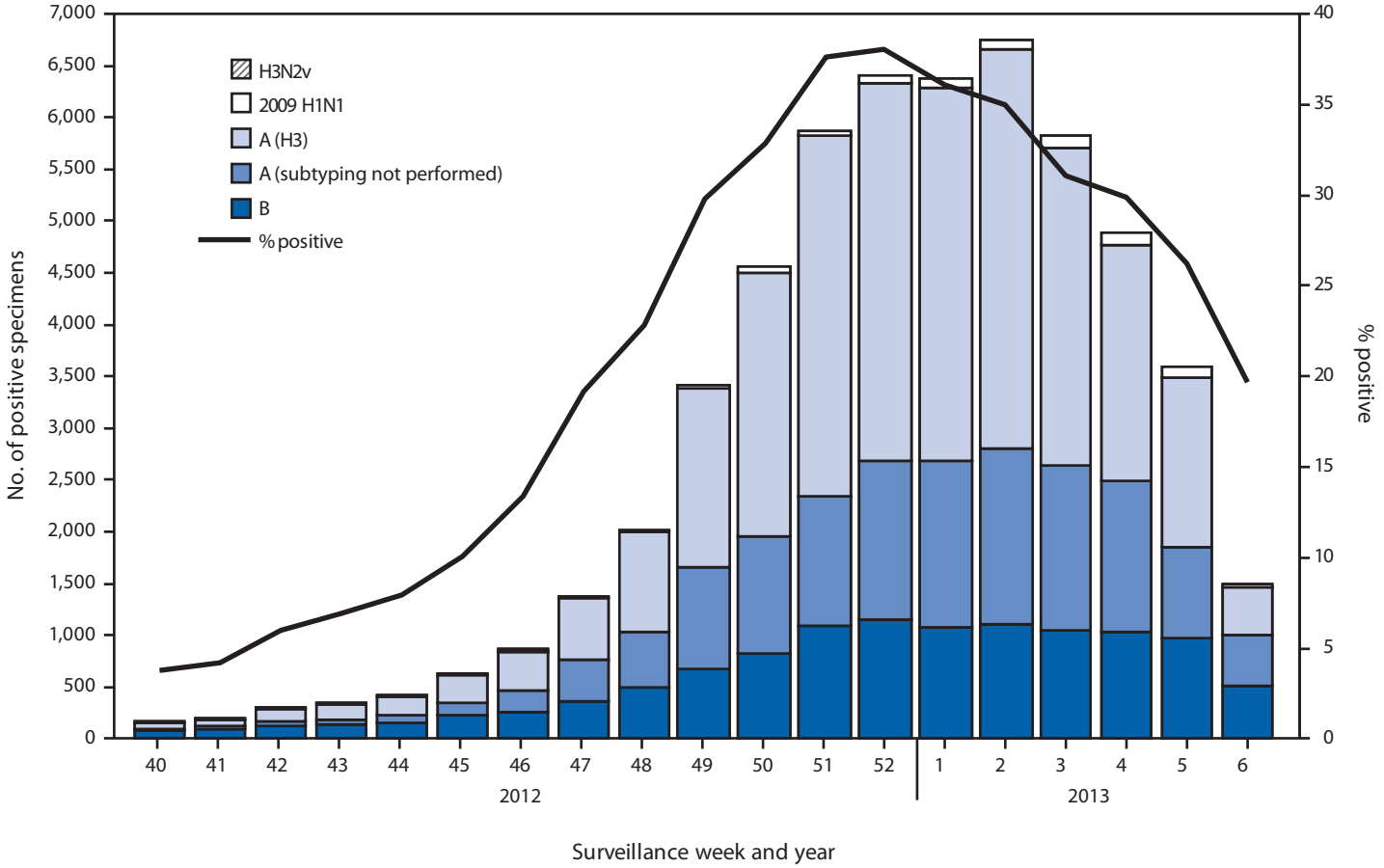
Since October 1, 2012, a total of 1,702 influenza viruses have been tested for resistance to influenza antiviral medications. None of the 1,072 influenza A (H3N2) or the 396 influenza B viruses was resistant to either oseltamivir or zanamivir. Among 234 pH1N1 viruses tested for resistance to oseltamivir, two (0.9%) were found to be resistant, and of the 97 viruses tested for resistance to zanamivir, none were found to be resistant, including one of the two oseltamivir-resistant pH1N1 viruses. Additional laboratory testing, including testing for resistance to zanamvir, is pending on the second oseltamivir-resistant pH1N1 virus. High levels of resistance to the adamantanes persist among pH1N1 and influenza A (H3N2) viruses.

Outpatient Illness Surveillance

Since September 30, 2012, the weekly percentage of outpatient visits for influenza-like illness (ILI)† reported by approximately 1,900 U.S. Outpatient ILI Surveillance Network (ILINet) providers in 50 states, New York City, Chicago, the U.S. Virgin Islands, and the District of Columbia that comprise ILINet, has ranged from 1.2% to 6.1%. From the week ending November 24, 2012 (week 47) to February 9, 2013 (week 6),

† Defined as a temperature ≥100°F (≥37.8°C), oral or equivalent, and cough or sore throat, without a known cause other than influenza.

FIGURE 1. Number and percentage of respiratory specimens testing positive for influenza, by type, surveillance week, and year — U.S. World Health Organization and National Respiratory and Enteric Virus Surveillance System collaborating laboratories, United States, 2012–13 influenza season



the percentage equaled or exceeded the national baseline[§] of 2.2% for 12 consecutive weeks (Figure 2). During the 1997–98 through 2011–12 seasons, peak weekly percentages of outpatient visits for ILI ranged from 2.4% to 7.7% and remained above baseline levels for an average of 12 weeks (range: 1–18 weeks). For the week ending February 9, 2013 (week 6), all 10 U.S. Department of Health and Human Services regions[¶] continued to report ILI activity above region-specific baseline levels.

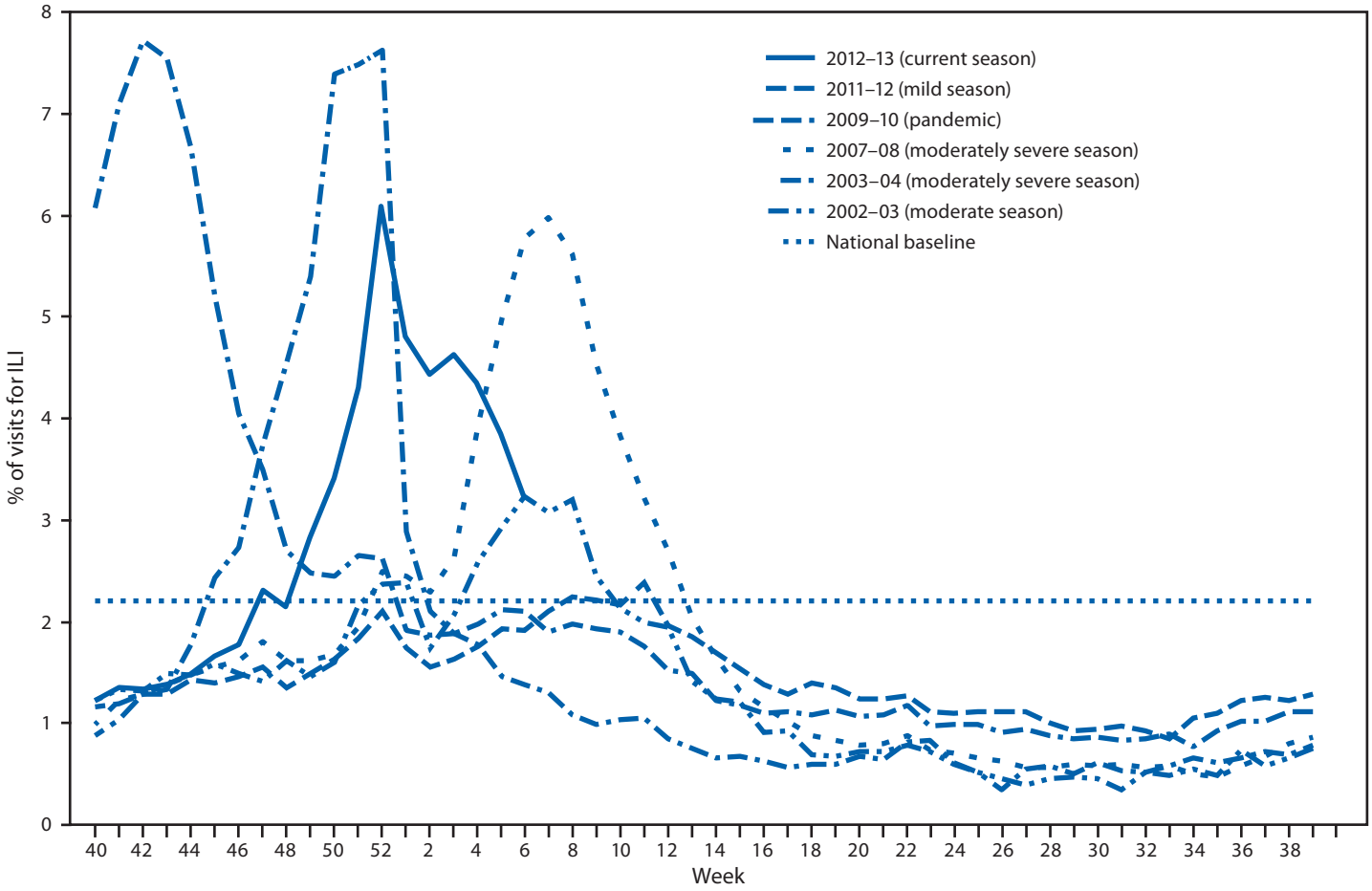
Data collected in ILINet are used to produce a measure of ILI activity[**] by jurisdiction. During the week ending February 9, 2013 (week 6), 11 states and New York City experienced high ILI activity (Alabama, California, Idaho, Kansas, Michigan, Missouri, Nevada, New Jersey, Texas, Utah, and Vermont), 10 states experienced moderate ILI activity (Arizona, Colorado, Illinois, Indiana, Louisiana, Minnesota, North Dakota, Oregon, South Dakota, and Virginia), 13 states and the District of Columbia experienced low ILI activity (Arkansas, Florida, Georgia, Hawaii, Iowa, Massachusetts, Mississippi, Nebraska, New Mexico, New York, Oklahoma, Washington, and Wyoming), and 16 states experienced minimal ILI

[§] The national and regional baselines are the mean percentage of visits for ILI during noninfluenza weeks for the previous three seasons plus two standard deviations. Noninfluenza weeks are defined as periods of 2 or more consecutive weeks in which each week accounted for less than 2% of the season's total number of specimens that tested positive for influenza. National and regional percentages of patient visits for ILI are weighted on the basis of state population. Use of the national baseline for regional data is not appropriate.

[¶] The 10 regions include the following jurisdictions: *Region 1*: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2*: New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands; *Region 3*: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4*: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5*: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6*: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7*: Iowa, Kansas, Missouri, and Nebraska; *Region 8*: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9*: Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau; and *Region 10*: Alaska, Idaho, Oregon, and Washington.

[**] Activity levels are based on the percentage of outpatient visits in a state attributed to ILI and are compared with the average percentage of ILI visits that occur during weeks with little influenza virus circulation. Activity levels range from minimal, which would correspond to ILI activity from outpatient clinics being at or below the average, to high, which would correspond to ILI activity from outpatient clinics being much higher than the average.

FIGURE 2. Percentage of visits for influenza-like illness (ILI) reported by the U.S. Outpatient Influenza-Like Illness Surveillance Network (ILINet), by surveillance week and year — United States, 2012–13 and selected previous influenza seasons*



* Data as of February 16, 2013.

activity (Alaska, Connecticut, Delaware, Kentucky, Maine, Maryland, Montana, New Hampshire, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, West Virginia, and Wisconsin). As of February 9, 2013, the largest total number of jurisdictions experiencing high ILI activity in a single week occurred during the week ending December 29, 2012 (week 52), when a total of 33 states and New York City experienced high ILI activity. The total number of jurisdictions experiencing high ILI activity in a single week during the 2008–09 through 2011–12 influenza seasons has ranged from four to 18 jurisdictions, excluding the 2009 pandemic, when 44 jurisdictions reported high ILI activity (CDC, unpublished data, 2013).

Geographic Spread of Influenza

For the week ending February 9, 2013 (week 6), the geographic spread of influenza[††] was reported as widespread in 31 states (Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New

[††] Levels of activity are 1) no activity; 2) sporadic: isolated laboratory-confirmed influenza cases or a laboratory-confirmed outbreak in one institution, with no increase in activity; 3) local: increased ILI, or at least two institutional outbreaks (ILI or laboratory-confirmed influenza) in one region of the state, with recent laboratory evidence of influenza in that region; virus activity no greater than sporadic in other regions; 4) regional: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least two but less than half of the regions in the state with recent laboratory evidence of influenza in those regions; and 5) widespread: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least half the regions in the state, with recent laboratory evidence of influenza in the state.

York, Ohio, Oklahoma, Oregon, Pennsylvania, Utah, Virginia, Washington, Wisconsin, and Wyoming), regional in Puerto Rico and 14 states (Alabama, Hawaii, Kentucky, Louisiana, Minnesota, Nebraska, Nevada, North Dakota, South Carolina, South Dakota, Tennessee, Texas, Vermont, and West Virginia), and local in the District of Columbia and four states (Georgia, Mississippi, North Carolina, and Rhode Island). Sporadic influenza activity was reported by Guam and one state (Delaware), and the U.S. Virgin Islands did not report. As of February 9, 2013, the number of jurisdictions reporting influenza activity as widespread peaked during the week ending January 12, 2013 (week 2), when a total of 48 jurisdictions reported influenza activity as widespread. The number of states reporting widespread activity during the peak week of activity has ranged from 25 to 49 states during the previous five influenza seasons (CDC, unpublished data, 2013).

Influenza-Associated Hospitalizations

CDC monitors hospitalizations associated with laboratory-confirmed influenza infection in adults and children through the Influenza Hospitalization Surveillance Network (FluSurv-NET),[§§] which covers approximately 9% of the U.S. population. From October 1, 2012, to February 9, 2013, a total of 8,953 laboratory-confirmed influenza associated hospitalizations were reported, with a cumulative incidence for all age groups of 32.1 per 100,000 population. The most affected age group was persons aged ≥65 years, accounting for more than 50% of reported influenza-associated hospitalizations. The cumulative hospitalization rate (per 100,000 population) from October 1, 2012, to February 9, 2013, was 44.0 among children aged 0–4 years, 9.3 among children aged 5–17 years, 11.6 among adults 18–49 years, 29.4 among adults aged 50–64 years, and 146.2 among adults aged ≥65 years (Figure 3). During the past three influenza seasons (2009–10 through 2011–12), end-of-season age-specific cumulative hospitalization rates ranged from 14.8 to 73.0 per 100,000 population for ages 0–4 years, 4.0 to 27.3 for ages 5–17 years, 4.1 to 23.3 for ages 18–49 years, 8.3 to 30.4 for ages 50–64 years, and 25.3 to 64.0 for ages ≥65 years. During the 2005–06 to the 2008–09 influenza seasons, end-of-season hospitalization rates among adults aged ≥65 years ranged from 13.5 to 73.8 per 100,000 population.

For the current season, the most commonly reported underlying medical conditions among hospitalized adults were cardiovascular disease, metabolic disorders, obesity, and chronic lung disease (excluding asthma). The most commonly reported underlying medical conditions in hospitalized children were asthma, neurologic disorders, and immune suppression. Forty-four percent of hospitalized children had no identified underlying medical conditions that place them at higher risk for influenza complications.[¶¶] Among 218 hospitalized women of childbearing age (15–44 years), 63 (29%) were pregnant.

Pneumonia and Influenza-Associated Mortality

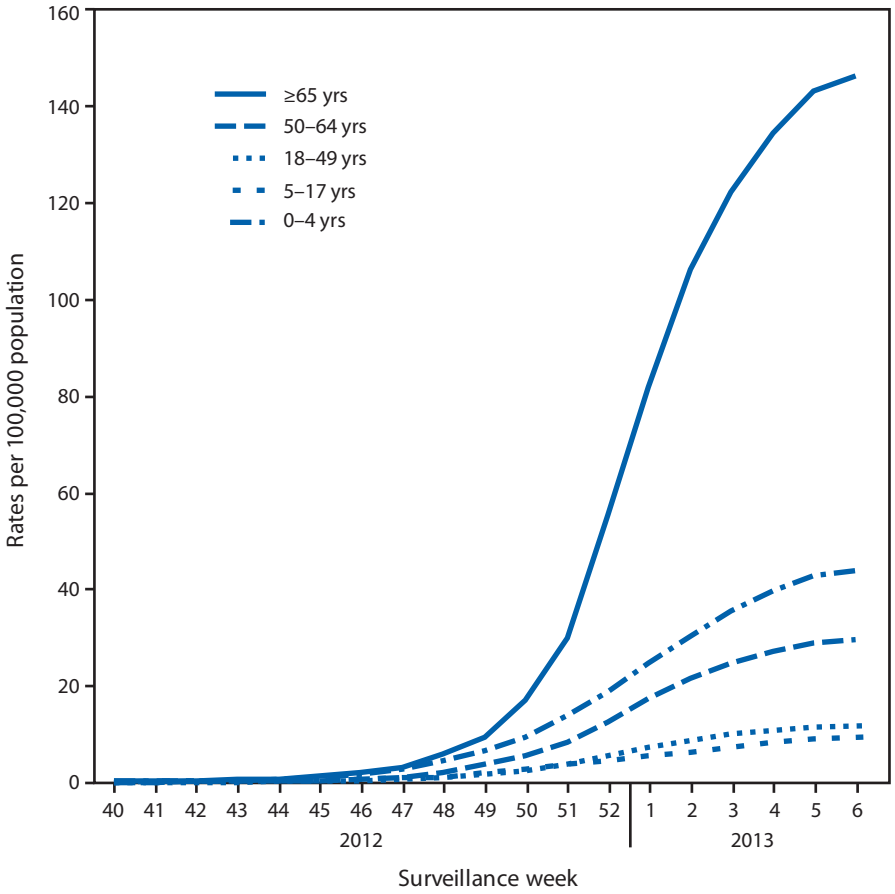
For the week ending February 9, 2013 (week 6), pneumonia and influenza (P&I) was reported as an underlying or contributing cause of death for 9.1% of all deaths reported to the 122 Cities Mortality Reporting System (Figure 4). This percentage is above the epidemic threshold of 7.5% for that week.[***] Since September 30, 2012, the weekly percentage of deaths attributed to P&I ranged from 5.8% to 9.9%, and, as of February 9, 2013 (week 6), had exceeded the epidemic threshold for 6 consecutive weeks (weeks ending January 5–February 9, 2013 [weeks 1–6]). As of February 9, 2013, the weekly percentage of deaths attributed to P&I peaked at 9.9% during the week ending January 19, 2013 (week 3). Peak weekly percentages of deaths attributed to P&I in the previous five seasons ranged

[§§] FluSurv-NET conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations in children aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). The FluSurv-NET covers approximately 80 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and additional Influenza Hospitalization Surveillance Project (IHSP) states. IHSP began during the 2009–10 season to enhance surveillance during the 2009 H1N1 pandemic. IHSP sites included Iowa, Idaho, Michigan, Oklahoma, and South Dakota during the 2009–10 season; Idaho, Michigan, Ohio, Oklahoma, Rhode Island, and Utah during the 2010–11 season; Michigan, Ohio, Rhode Island, and Utah during the 2011–12 season; and Iowa, Michigan, Ohio, Rhode Island, and Utah during the 2012–13 season. Incidence rates are calculated using CDC's National Center for Health Statistics population estimates for the counties included in the surveillance catchment area. Laboratory confirmation is dependent on clinician-ordered influenza testing, and testing for influenza often is underutilized because of the poor reliability of rapid test results and greater reliance on clinical diagnosis for influenza. As a consequence, cases identified as part of influenza hospitalization surveillance likely are an underestimation of the actual number of persons hospitalized with influenza.

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

[***] The seasonal baseline proportion of P&I deaths is projected using a robust regression procedure in which a periodic regression model is applied to the observed percentage of deaths from P&I that were reported by the 122 Cities Mortality Reporting System during the preceding 5 years. The epidemic threshold is set at 1.645 standard deviations above the seasonal baseline.

FIGURE 3. Rates of hospitalization for laboratory-confirmed influenza, by age group and surveillance week — FluSurv-NET,* 2012–13 influenza season†



* FluSurv-NET conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations in children aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). The FluSurv-NET covers approximately 80 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and additional Influenza Hospitalization Surveillance Project states (Iowa, Michigan, Ohio, Rhode Island, and Utah).

† Data as of February 16, 2013.

from 7.9% for the 2008–09 and 2011–12 seasons to 9.1% during the 2007–08 and 2010–11 seasons.

Influenza-Associated Pediatric Mortality

As of February 9, 2013, a total of 64 laboratory-confirmed influenza-associated pediatric deaths occurring during the 2012–13 season had been reported to CDC from Chicago, New York City, and 27 states. The mean and median ages of children reported to have died were 7.9 and 7.4 years, respectively; three children were aged <6 months, 11 were aged 6–23 months, eight were aged 2–4 years, 24 were aged 5–11 years, and 18 were aged 12–17 years. Of the 64 deaths, 16 were associated with influenza A (H3N2) virus infection, 19 deaths were associated with an influenza A virus infection that was not subtyped, and 29 deaths were associated with influenza B infection. Since 2004, when CDC began collection of influenza-associated pediatric death data, each season approximately 20% of children aged ≥6 months who were eligible to receive seasonal influenza vaccination and died from influenza-associated complications had received the seasonal influenza vaccine (CDC, unpublished data, 2013). Since influenza-associated pediatric mortality became a nationally notifiable disease in 2004, the total number of influenza-associated pediatric deaths has ranged from 34 to 122 per season; excluding the 2009 pandemic, when 348 pediatric deaths were reported to CDC during April 15, 2009, through October 2, 2010.

Reported by

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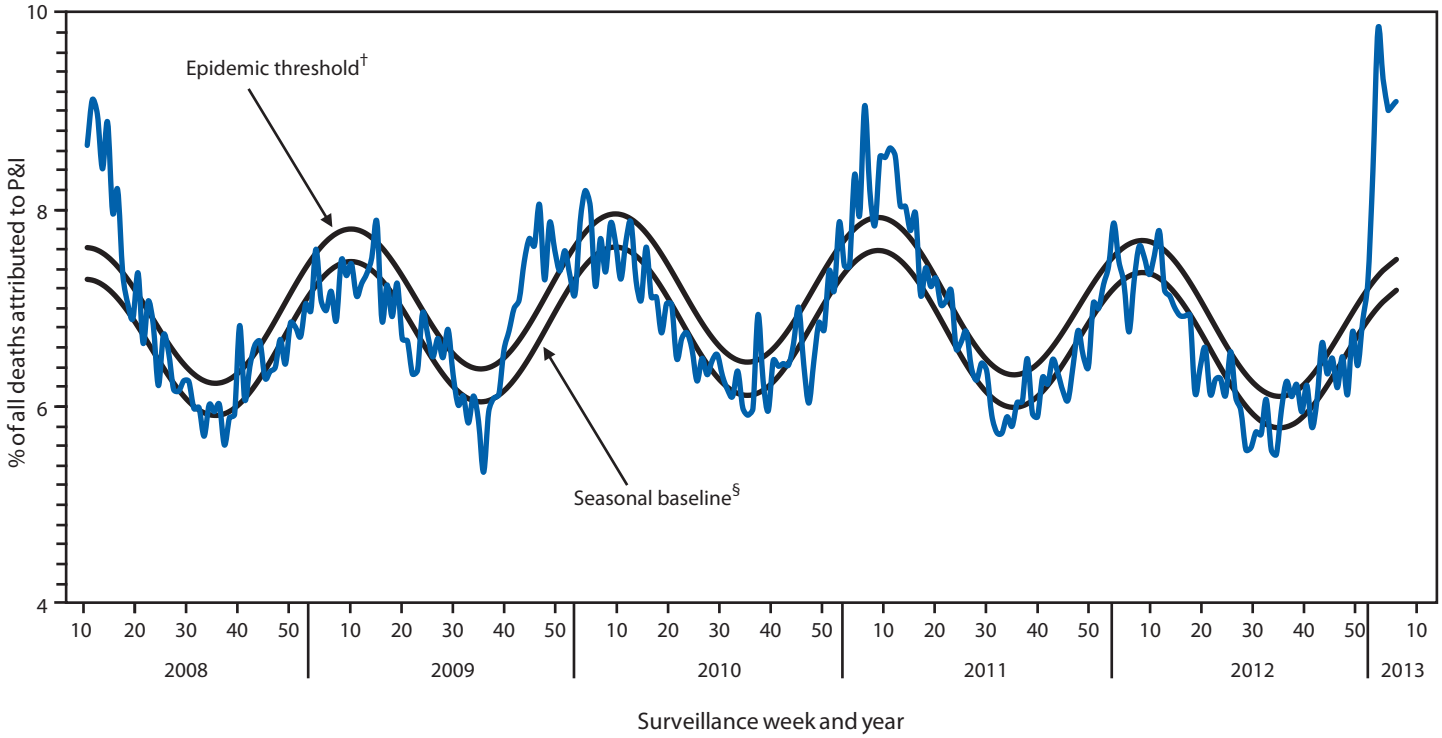
Editorial Note

The 2012–13 influenza season began early, and influenza activity remained elevated across the United States as of February 9, 2013; during the most recent weeks, decreases have been observed in the South and East, while increases have continued in the West. Although the timing of influenza activity is not predictable, substantial activity can occur as late as May (*2*). During September 30, 2012–February 9, 2013, influenza A (H3N2) viruses were identified most frequently, followed by influenza B viruses, but a small number of pH1N1 viruses also were reported. Antigenic characterization of influenza-positive respiratory specimens submitted to CDC indicated that the majority of these specimens were like the 2012–13 influenza vaccine components. As of February 9, 2013, more than half of influenza-associated hospitalizations were reported to have occurred in adults aged ≥65 years, and rates of influenza-associated hospitalization

FIGURE 4. Percentage of all deaths attributable to pneumonia and influenza (P&I), by surveillance week and year — 122 U.S. Cities Mortality Reporting System, United States, 2008–2013*



* For the reporting week ending February 9, 2013.
† The epidemic threshold is 1.645 standard deviations above the seasonal baseline.
§ The seasonal baseline is projected using a robust regression procedure that applies a periodic regression model to the observed percentage of deaths from P&I during the preceding 5 years.

What is already known on this topic?

CDC collects, compiles, and analyzes data on influenza activity year-round in the United States. The timing and severity of circulating influenza viruses can vary by geographic location and season.

What is added by this report?

Influenza activity in the United States began to increase in mid-November and remained elevated through February 9, 2013. During September 30, 2012–February 9, 2013, of 55,470 influenza viruses tested, 79% were influenza A, and 19% were influenza B. Of 29,914 influenza A viruses that were subtyped, 97% were H3N2, and 3% were pH1N1. The age group with the highest hospitalization rate was ≥65 years, accounting for more than half of all reported influenza-associated hospitalizations.

What are the implications for public health practice?

Year-round influenza surveillance provides critical information for planning interventions to prevent and control influenza, developing vaccine recommendations and antiviral treatment guidance, and presenting information to the public regarding the progress and severity of the influenza season.

among adults aged ≥65 years increased sharply from late December through January. The weekly percentage of deaths attributed to P&I was above the epidemic threshold beginning early in January, with the majority of the P&I deaths occurring in adults aged ≥65 years.

In the past, higher overall and age-specific rates of hospitalization and mortality have been observed during influenza A (H3N2)–predominant seasons (*3,4*). Based on FluSurv-Net surveillance data for the 2012–13 season to date, rates of influenza-associated hospitalizations are highest among adults aged ≥65 years, followed by children aged 0–4 years. This trend is similar to that observed in the 2007–08 and 2010–11 influenza seasons, during which influenza A (H3N2) viruses predominated. The number and rate of influenza-associated hospitalizations among adults aged ≥65 years during the 2012–13 influenza season is the highest since data collection on laboratory-confirmed influenza-associated hospitalization in adults began in the 2005–06 season.

Vaccination remains the first and best way to prevent influenza and its complications. Health-care providers should continue to offer vaccine to all unvaccinated persons aged ≥6

months throughout the influenza season. Interim vaccine effectiveness estimates suggest that effectiveness against influenza A (H3N2) viruses is lower and not statistically significant in adults aged ≥65 years during the 2012–13 influenza season (*5*). Adults aged ≥65 years are at the greatest risk for hospitalization and death from influenza-associated complications; therefore, it is important for them to receive their annual influenza vaccine, take everyday preventive actions, and seek medical care quickly if they develop ILI symptoms to see if treatment with antiviral medications is needed. Antiviral medications remain an important adjunct to vaccination for reducing the health impact of influenza. Recommended antiviral medications are oseltamivir and zanamivir. Early and aggressive treatment with antiviral medication is crucial, ideally within the first 48 hours of illness onset, and persons with suspected influenza infection who are at high risk, including adults aged ≥65 years, should be treated with antiviral medications without the need to wait for laboratory confirmation of influenza (*6*). However, as indicated by observational studies, antiviral treatment might still be beneficial in patients with severe, complicated, or progressive illness and in hospitalized patients when started after 48 hours of illness onset (*6*). Recent data on influenza antiviral resistance indicate that >99% of currently circulating influenza virus strains are sensitive to these medications.

Influenza surveillance reports for the United States are posted online weekly and are available at http://www.cdc.gov/flu/weekly. Additional information regarding influenza viruses, influenza surveillance, influenza vaccine, influenza antiviral medications, and novel influenza A infections in humans is available at http://www.cdc.gov/flu.

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Participating state, city, county, and territorial health departments and public health laboratories; U.S. World Health Organization collaborating laboratories; the National Respiratory and Enteric Virus Surveillance System collaborating laboratories; the U.S. Outpatient Influenza-Like Illness Surveillance Network; the Influenza Hospitalization Surveillance Network; the Influenza-Associated Pediatric Mortality Surveillance System; and the 122 Cities Mortality Reporting System.

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Updated Recommendations for Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccine (Tdap) in Pregnant Women — Advisory Committee on Immunization Practices (ACIP), 2012

In October 2011, in an effort to reduce the burden of pertussis in infants, the Advisory Committee on Immunization Practices (ACIP) recommended that unvaccinated pregnant women receive a dose of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) (*1*). Vaccination of women with Tdap during pregnancy is expected to provide some protection to infants from pertussis until they are old enough to be vaccinated themselves. Tdap given to pregnant women will stimulate the development of maternal antipertussis antibodies, which will pass through the placenta, likely providing the newborn with protection against pertussis in early life, and will protect the mother from pertussis around the time of delivery, making her less likely to become infected and transmit pertussis to her infant (*1*). The 2011 Tdap recommendation did not call for vaccinating pregnant women previously vaccinated with Tdap. On October 24, 2012, ACIP voted to recommend use of Tdap during every pregnancy. This report summarizes data considered and conclusions made by ACIP and provides guidance for implementing its recommendations. These updated recommendations on use of Tdap in pregnant women aim to optimize strategies for preventing pertussis morbidity and mortality in infants.

ACIP is chartered as a federal advisory committee to provide expert external advice and guidance to the Director of the Centers for Disease Control and Prevention (CDC) on use of vaccines and related agents for the control of vaccine-preventable diseases in the civilian population of the United States. Recommendations for routine use of vaccines in children and adolescents are harmonized to the greatest extent possible with recommendations made by the American Academy of Pediatrics, the American Academy of Family Physicians (AAFP), and the American College of Obstetricians and Gynecologists. Recommendations for routine use of vaccines in adults are reviewed and approved by the American College of Physicians, AAFP, the American College of Obstetricians and Gynecologists, and the American College of Nurse-Midwives. ACIP recommendations adopted by the CDC Director become agency guidelines on the date published in the *Morbidity and Mortality Weekly Report* (*MMWR*).

The United States has experienced substantial increases in reported pertussis cases over the past several years. Provisional case counts for 2012 have surpassed the last peak year, 2010, with 41,880 pertussis cases and 14 deaths in infants aged <12 months (*2*) (CDC, unpublished data, 2012). To reduce this burden, optimizing the current vaccination program and protecting infants who are at highest risk for death are immediate priorities. Since the 2011 ACIP vaccination recommendation, uptake of Tdap among pregnant women has been low; one survey of 1,231 women (August 2011 to April 2012) estimated that only 2.6% of women received Tdap during their recent pregnancy (*3*). New data indicate that maternal antipertussis antibodies are short-lived; therefore, Tdap vaccination in one pregnancy will not provide high levels of antibodies to protect newborns during subsequent pregnancies (*4*).

Methods

In monthly teleconferences during 2012, the ACIP Pertussis Vaccines Work Group considered published, peer-reviewed literature and unpublished data relevant to vaccinating pregnant women with Tdap. When data were not available, expert opinion was considered. Summaries of the data reviewed and work group discussions were presented to ACIP before recommendations were proposed. The proposed Tdap recommendation for pregnant women was presented at the October 2012 ACIP meeting and approved by ACIP.

Summary of ACIP Deliberations and Rationale

A dose of Tdap during each pregnancy

Very young infants are dependent solely on maternal antibodies and lack the ability to mount a cell-mediated response (*4*). The effectiveness and optimal concentration of maternal antipertussis antibodies in newborns are not yet known, but high levels of antibodies in the first weeks after birth likely confer protection and might prevent pertussis or modify disease severity (*5–7*). Studies on the persistence of antipertussis antibodies following a dose of Tdap show antibody levels in healthy, nonpregnant adults peak during the first month after vaccination, with substantial antibody decay after 1 year (*8–10*). Antibody kinetics in pregnant women likely would be similar. One study evaluated persistence of maternal

antipertussis antibody concentrations from maternal delivery and cord blood pairs from women who received Tdap within the prior 2 years (*4*). The estimated antipertussis antibody concentrations at birth in most of these infants were considered unlikely to provide adequate protection. These findings indicate that maternal antibodies from women immunized before pregnancy waned quickly and the concentration of maternal antibodies was unlikely to be high enough to provide passive protection to infants (*4*). Because antibody levels wane substantially during the first year after vaccination, ACIP concluded a single dose of Tdap at one pregnancy would be insufficient to provide protection for subsequent pregnancies.

Potential Impact of Tdap During Pregnancy

For the 2011 ACIP recommendation, ACIP reviewed a decision analysis model developed to assess the impact and cost effectiveness of Tdap vaccination during pregnancy compared with immediately postpartum vaccination (*1*). The model showed that Tdap vaccination during pregnancy would prevent more infant cases, hospitalizations, and deaths compared with the postpartum dose (*11*).

For this updated recommendation, the model was rereviewed and the analysis updated. To estimate the potential impact of Tdap given either during pregnancy or postpartum, percent mean reductions were applied to the annual mean number of reported pertussis cases in infants aged <12 months during 2000–2011 (CDC, unpublished data, 2011). During 2000–2011, the annual mean of pertussis cases in infants aged <12 months was 2,746 (range: 1,803–4,298), hospitalizations was 1,217 (range: 687–1,938), and deaths was 18 (range: 8–35) (CDC, unpublished data, 2011). Based on the model, Tdap vaccination during pregnancy might prevent 906 (range: 595–1,418) infant cases, 462 (range: 261–736) hospitalizations, and nine (range: 4–17) deaths; a postpartum dose might prevent 549 (range: 361–860) infant cases, 219 (range: 124–349) hospitalizations, and three (range: 1–6) deaths (CDC, unpublished data, 2012).

Birth Statistics in the United States

To address the likelihood that women might receive Tdap during consecutive pregnancies in a short period, and therefore theoretically be at greater risk for adverse reactions, ACIP reviewed available data on birth statistics. In the United States, approximately 4 million births are reported each year, and an average of 2.06 children are born per woman in a lifetime (*12,13*). Among women with more than one pregnancy, only 2.5% have an interval ≤12 months between births (*14*). The majority of women, who have two pregnancies, have an interval of ≥13 months between births (*14*). For women of lower socioeconomic status, the interval between pregnancies generally is ≥18 months (*15*). Approximately 5% of women have four or more babies (*16*). ACIP concluded that the interval between subsequent pregnancies is likely longer than the persistence of maternal antipertussis antibodies, and were reassured that most women would receive only 2 Tdap doses and a small proportion of women would receive ≥4 doses of Tdap.

Safety of Repeat Tdap Administration to Pregnant Women

In 2011, ACIP concluded that available data did not suggest any elevated frequency or unusual patterns of adverse events in pregnant women who received Tdap and that the few serious adverse events reported were unlikely to have been caused by the vaccine; at that time, a dose of Tdap for every pregnancy was not considered (*9*). Published data on receipt of 2 doses of Tdap and multiple doses of tetanus toxoid–containing vaccines were reviewed. Receipt of a second dose of Tdap at a 5- or 10-year interval in healthy nonpregnant adolescents and adults was well tolerated; injection site pain was the most commonly reported adverse event (*9,17–20*). The frequency of reported adverse events for the second dose was similar to the first dose in these same subjects and in naïve controls receiving Tdap for the first time. Of the few serious adverse events reported, none were attributed to the vaccine. Fever was reported in 2.4%–6.5% of recipients of a Tdap booster; the frequency of fever was similar to that in the same subjects after their first Tdap dose and in naïve controls (*9,17–19*). Studies on short intervals (i.e., within 21 days or ≤2 years) between receipt of tetanus and diphtheria toxoids (Td) and Tdap or Tdap-inactivated polio vaccine in healthy, nonpregnant adolescents and adults found no serious adverse events (*21–23*). Fever was reported in 1.7%–6.8% of subjects who received Tdap ≤2 years after Td; rates were comparable to the control group and to cohorts that received Tdap longer after receipt of Td (*21,22*). The number of subjects in these studies was small, and therefore, the findings do not rule out the possibility of rare but serious adverse events.

A theoretical risk exists for severe local reactions (e.g., Arthus reactions, whole limb swelling) for pregnant women who have multiple closely spaced pregnancies. Arthus reactions and whole limb swelling are hypersensitivity reactions that have been associated with vaccines containing tetanus toxoid, tetanus and diphtheria toxoids, and/or pertussis antigens. Historical data on multiple doses of Td and tetanus toxoid vaccines (TT) indicate that hypersensitivity was associated with higher levels of preexisting antibody (*24–26*). The frequency of side effects depended on antigen content, product formulation, preexisting antibody levels related to the interval since last dose, and the number of doses (*24–26*). Challenges

to reviewing historical data on multiple doses of TT and Td include differences in adjuvant and toxoid amounts in vaccines over time and severity of adverse events by number of vaccines received (*24–26*). Most of the data are historical, and the risk for severe adverse events likely has been reduced with current formulations that contain lower doses of TT.

TT and Td have been used extensively in pregnant women worldwide to prevent neonatal tetanus; large studies on use of TT during pregnancy have not reported clinically significant severe adverse events (*27–30*). Safety data on use of Td during multiple pregnancies have not been published. ACIP believes the potential benefit of preventing pertussis morbidity and mortality in infants outweighs the theoretical concerns of possible severe adverse events.

ACIP concluded that experience with tetanus-toxoid containing vaccines suggests no excess risk for severe adverse events for women receiving Tdap with every pregnancy. ACIP stated the need for safety studies of severe adverse events when Tdap is given during subsequent pregnancies. Plans for safety monitoring in pregnant women following Tdap administration include enhanced monitoring in Vaccine Adverse Event Reporting System (VAERS) and utilizing the Vaccine Safety Datalink (VSD) to assess acute adverse events, adverse pregnancy outcomes affecting the mother, and birth outcomes; assessing risks for rare adverse events in pregnant women after Tdap will require data collection for several years (*31*).

Vaccination During the Third Trimester

Tdap may be administered any time during pregnancy, but vaccination during the third trimester would provide the highest concentration of maternal antibodies to be transferred closer to birth (*4*). After receipt of Tdap, a minimum of 2 weeks is required to mount a maximal immune response to the vaccine antigens (*32,33*). Active transport of maternal immunoglobulin G does not substantially take place before 30 weeks of gestation (*34*). One study of pregnant women who received Tdap within the prior 2 years noted that maternal antibodies waned quickly; even women immunized during the first or second trimester had low levels of antibodies at term (*4*). Therefore, to optimize the concentration of vaccine-specific antipertussis antibodies transported from mother to infant, ACIP concluded that pregnant women should be vaccinated with Tdap during the third trimester.

ACIP Recommendations for Pregnant Women

ACIP recommends that providers of prenatal care implement a Tdap immunization program for all pregnant women. Health-care personnel should administer a dose of Tdap during each pregnancy, irrespective of the patient's prior history of receiving Tdap.

Guidance for Use

To maximize the maternal antibody response and passive antibody transfer to the infant, optimal timing for Tdap administration is between 27 and 36 weeks gestation although Tdap may be given at any time during pregnancy. For women not previously vaccinated with Tdap, if Tdap is not administered during pregnancy, Tdap should be administered immediately postpartum.

Special Situations

Pregnant women due for tetanus booster. If a tetanus and diphtheria booster vaccination is indicated during pregnancy (i.e., >10 years since previous Td), then Tdap should be administered. Optimal timing is between 27 and 36 weeks gestation to maximize the maternal antibody response and passive antibody transfer to the infant.

Wound management for pregnant women. As part of standard wound management to prevent tetanus, a tetanus toxoid–containing vaccine might be recommended for wound management in a pregnant woman if ≥5 years have elapsed since the previous Td booster. If a Td booster is recommended for a pregnant woman, health-care providers should administer Tdap.

Pregnant women with unknown or incomplete tetanus vaccination. To ensure protection against maternal and neonatal tetanus, pregnant women who never have been vaccinated against tetanus should receive three vaccinations containing tetanus and reduced diphtheria toxoids. The recommended schedule is 0, 4 weeks, and 6 through 12 months. Tdap should replace 1 dose of Td, preferably between 27 and 36 weeks gestation to maximize the maternal antibody response and passive antibody transfer to the infant.

Cocooning

ACIP recommends that adolescents and adults (e.g., parents, siblings, grandparents, child-care providers, and health-care personnel) who have or anticipate having close contact with an infant aged <12 months should receive a single dose of Tdap to protect against pertussis if they have not received Tdap previously. Guidance will be forthcoming on revaccination of persons who anticipate close contact with an infant, including postpartum women who previously have received Tdap.

Research Needs

Future research needs will address the effectiveness of Tdap vaccination of pregnant women to prevent infant pertussis morbidity and mortality, the impact of timing of Tdap during

pregnancy on infant pertussis, and safety of multiple doses of Tdap in pregnant women. CDC will monitor and assess the safety of Tdap use during pregnancy. Results from these studies and monitoring systems will inform future considerations made by ACIP on use of Tdap in preventing infant pertussis morbidity and mortality.

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Acknowledgments

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Notes from the Field

Zinc Deficiency Dermatitis in Cholestatic Extremely Premature Infants After a Nationwide Shortage of Injectable Zinc — Washington, DC, December 2012

In mid-December 2012, three extremely premature infants with cholestasis in a neonatal intensive care unit (NICU) developed dermatitis in the diaper region, perioral erosions, and bullae on the dorsal surfaces of their hands and feet (Figure). The infants were similar in gestational age (23–24 weeks) and corrected postnatal age (33–38 weeks). All had severe cholestasis (direct bilirubin >3 mg/dL) and had received prolonged parenteral nutrition (PN). Each infant was in a private room and cared for by different nurses.

A search for environmental causes addressed infectious and toxic etiologies, medication reactions, use of new adhesives, and changes in PN. Searches for an infectious cause, including bacterial (wound, blood, urine, cerebrospinal fluid) and viral cultures, were negative. One infant treated empirically with intravenous antibiotics and acyclovir showed no improvement.

Recognition of the nationwide shortage of injectable zinc focused attention on the possibility of zinc deficiency. The hospital's PN pharmacy exhausted its supply of injectable zinc on November 21, 2012, and the infants had not received zinc supplementation as of mid-December. Because other preparations of parenteral trace elements contain insufficient zinc to meet premature infants' requirements and might cause trace element toxicity in cholestatic infants, no alternatives to the injectable zinc supplements were available.

The ranges of levels of plasma zinc (14–56 μg/dL [normal: 70–120 μg/dL]) and alkaline phosphatase, a zinc-dependent enzyme (32–62 U/L [normal: 150–420 U/L]), in the three infants were markedly low. Skin biopsy specimens from two of the infants showed findings consistent with zinc deficiency dermatitis. The fraternal twin of one of the infants received full-formula feedings and was clinically and biochemically unaffected. The infants' skin lesions were managed with petrolatum dressings, and their PN was supplemented with zinc-containing enteral supplements. As their zinc levels improved, so did their skin lesions.

Zinc is an essential cofactor in approximately 300 enzyme-dependent processes. Fetal zinc accumulation via placental transport is maximal at 24–34 weeks of gestation. Extremely premature infants require 400 mg/kg per day because of negligible tissue stores of zinc, low albumin binding, increased catabolic state, and increased urinary zinc losses (*1*). Inadequate zinc supplementation leads to cutaneous changes, diarrhea, immunologic impairment, growth failure, and poor wound healing.

FIGURE. Zinc deficiency dermatitis manifesting as bullous and erosive lesions on the hands and feet of a newborn infant — Washington, DC, December 2012

Photo/S.A. Norton, Children's National Medical Center

Because of the nationwide shortage of injectable zinc, other NICUs caring for PN-dependent, extremely premature, cholestatic infants might encounter similar cases. The two U.S. manufacturers of injectable zinc, Hospira (zinc chloride) and American Regent (zinc sulfate), have no available inventory. Hospira expects to resume production in March 2013 (*2*).The American Society for Parenteral and Enteral Nutrition provides recommendations for conserving and prioritizing trace element products in short supply (*3*). NICUs should monitor levels of zinc in infants at risk.

Reported by

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Announcement

Introduction to Public Health Surveillance Course

CDC and the Rollins School of Public Health at Emory University will cosponsor the course, Introduction to Public Health Surveillance, May 20–24, 2013, at Emory University in Atlanta, Georgia. The course is designed for state and local public health professionals.

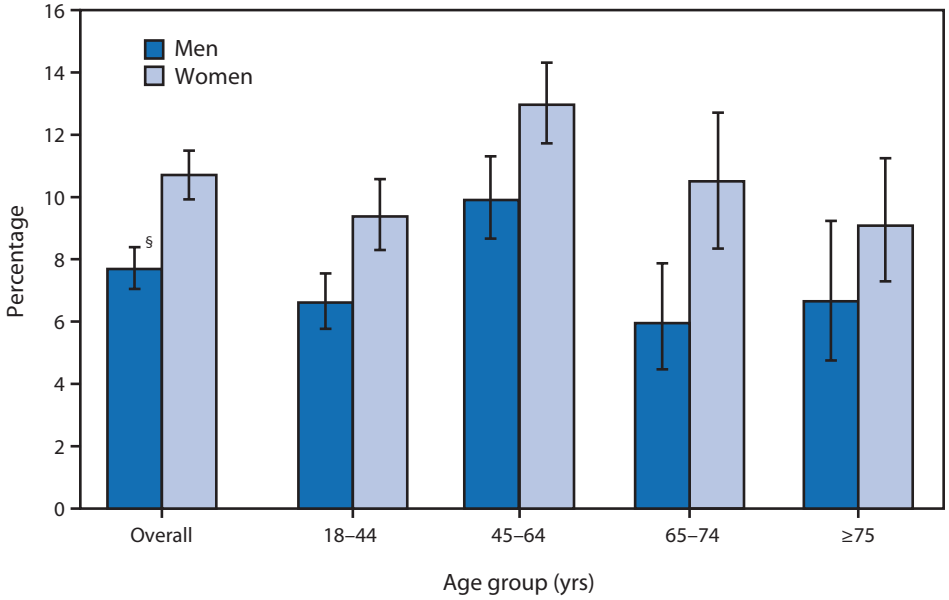
The course will provide theoretical and practical knowledge to design, implement, and evaluate effective public health surveillance programs. Topics scheduled for presentation include an overview and history of surveillance systems; planning considerations; sources and collection of data; analysis, interpretation, and communication of data; surveillance systems technology; ethics and legalities; state and local concerns; and future considerations. Tuition is charged.

Additional information and applications are available online (http://www.sph.emory.edu/epicourses); by e-mail (pvaleri@emory.edu); by mail (Emory University, Hubert Department of Global Health, 1518 Clifton Rd. NE, CNR Bldg., Rm. 7038, Atlanta, GA 30322); by telephone (404-727-3485); or by fax (404-727-4590).

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged ≥18 Years Who Often Felt Depressed,* by Sex and Age Group — National Health Interview Survey, United States, 2010–2011†



* Respondents were asked: "How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?" Persons having daily or weekly feelings of depression were categorized as often depressed. Unknowns were not included in the denominators when calculating percentages.
† Estimates are based on household interviews of a sample of the U.S. civilian, noninstitutionalized population.
§ 95% confidence interval.

During 2010–2011, women were more likely than men to often feel depressed (10.7% compared with 7.7%), overall and among those aged 18–44, 45–64, and 65–74 years. For both men (9.9%) and women (13.0%), the prevalence of depression was highest among those aged 45–64 years.

Source: National Health Interview Survey, 2010 Quality of Life and 2011 Functioning and Disability supplements. Data are from a subset of the adults randomly selected for the Sample Adult Component of the National Health Interview Survey questionnaire. Available at http://www.cdc.gov/nchs/nhis.htm.

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