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Influenza vaccination among workers – 21 US states, 2013

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Abstract

Background—Influenza illnesses can result in missed days at work and societal costs, but influenza vaccination can reduce the risk of disease. Knowledge of vaccination coverage by industry and occupation can help guide prevention efforts and be useful during influenza pandemic planning.

Methods—Data from 21 states using the 2013 Behavioral Risk Factor Surveillance System (BRFSS) industry/occupation module were analyzed. Influenza vaccination coverage was reported by select industry and occupation groups, including healthcare personnel (HCP) and other occupational groups who may have first priority to receive influenza vaccination during a pandemic ("Tier 1"). T-tests were used to make comparisons between groups.

Results—Influenza vaccination coverage varied by industry and occupation, with high coverage among persons in healthcare industries and occupations. About half of persons classified as Tier 1 received influenza vaccination, and vaccination coverage among Tier 1 and HCP groups varied widely by state.

Conclusions—This report points to the particular industries and occupations where improvement in influenza vaccination coverage is needed. Prior to a pandemic event, more specificity on occupational codes to define exact industries and occupations in each Tier group would be beneficial in implementing pandemic influenza vaccination programs and monitoring the success of these programs.

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Introduction

Influenza illnesses can result in missed days at work and societal costs [1]. Healthcare personnel (HCP) can acquire influenza infection at work from patients and may serve as sources of infection for patients, other HCP, and family members [2, 3]. Other types of workers can also acquire and spread infections at work due to close contact with coworkers or customers. The Advisory Committee on Immunization Practices (ACIP) recommends annual influenza vaccination for all persons aged ≥6 months (including HCP) [2, 4]. A recent study using Internet panel survey data indicated that about 77.3% of HCP reported influenza vaccination in the 2014-15 season, and 40% of HCP were required to be vaccinated by their employers, with highest rates of vaccination occurring among those with workplace requirements [5]. Benefits of HCP influenza vaccination on patient outcomes, HCP absenteeism, and reduction of influenza infection among HCP have been documented [6-9].

Knowledge of influenza vaccination coverage among HCP and other occupational groups can help guide prevention efforts and be useful during an outbreak response. Additionally, influenza vaccination coverage rates can assist in influenza pandemic planning. The U.S. Department of Health and Human Services (HHS) and Department of Homeland Security (DHS) have developed guidance to support planning an effective and consistent pandemic response by states and communities, including prioritizing pandemic influenza vaccine based on occupation or age and health status when supplies are limited to include selected groups of persons who are critical for providing essential services during a pandemic [10]. An influenza pandemic will likely increase the burden on health care providers and institutions and may disrupt the provision of critical products and services in health care and other sectors. National and homeland security could be threatened if illness among military and other critical personnel reduces their capabilities. Therefore, highest priority groups (Tier 1) are those that will be immunized first and include deployed and mission critical personnel, front-line public health responders, essential health care workers, emergency medical service providers, law enforcement personnel, fire services personnel, and high-risk populations (pregnant women, infants and toddlers). The goal of a pandemic vaccination program is to include everyone and those who are not included in an occupational group will be vaccinated as part of the general population based on their age and health status [10].

This paper updates influenza vaccination coverage estimates among select groups who likely have high exposure to the public and might be at increased risk for infection during a pandemic, provides inter-pandemic coverage estimates for groups in the highest tier for allocating pandemic influenza vaccines, and provides estimates of influenza vaccination coverage across specific industry sectors and occupational groups.

Methods

The Behavioral Risk Factor Surveillance System (BRFSS) is an ongoing state-based telephone survey coordinated by state health departments in collaboration with the Centers for Disease Control and Prevention (CDC). Each year the BRFSS collects information on health conditions and risk behaviors from approximately 400,000 randomly-selected persons ≥18 years among the non-institutionalized, U.S. population.

In the 2013 BRFSS survey, the National Institute for Occupational Safety and Health (NIOSH) supported an optional industry/occupation (I/O) module. Data from 21 states[1] that administered the 2013 BRFSS I/O module were analyzed in 2015[2]. The I/O module included two questions asked of respondents who reported being employed for wages, self-employed, or out of work for less than one year at the time of the survey. The first question elicited the worker's occupation by asking, “What kind of work do you do (for example, registered nurse, janitor, cashier, auto mechanic)?” or for those out of work for less than one year, “What kind of work did you do?” Industry was next elicited with, “What kind of business or industry do you/did you work in (for example, hospital, elementary school, clothing manufacturing, restaurant)?” The analytic data file included both BRFSS I/O data and data from the BRFSS core, including data on demographic and access-to-care variables, as well as variables on influenza vaccination. In the 2013 BRFSS, approximately 0.26% of the sample in the 21 states included military personnel living in residential or college housing, but the BRFSS does not collect information on deployed military personnel or those living in barracks. The median state response rate in 2013 for the 21 states included in this report was 44.0% (the median for the entire 2013 BRFSS survey was 46.4%) [11].

Industry/occupation responses were coded to 2002 Census industry/occupation codes, which are consistent with the federal government's standard industry and occupation classification systems[12]. The public software, NIOSH Industry and Occupation Computerized Coding System (NIOCCS), autocoded 40% of BRFSS 2013 I/O data (the system currently autocodes an average of 52%-55% of data) [13]. The remainder were coded by human coders. In total, approximately 97% of BRFSS I/O data were coded by NIOCCS and human coders, while the other 3% could not be coded due to vague responses. In addition to the 3% not coded due to vague responses, respondents were also excluded if they refused to answer or did not know the answer to the I/O questions. Among 106,348 employed respondents with data on age (including persons out of work less than one year), 18,757 (17.6%) were excluded from the analysis of industry and 17,872 (16.8%) from the analysis of occupation because they could not be coded for one of the reasons listed above.

Where possible, Census codes were converted to equivalent 2002 North American Industry Classification System (NAICS) and 2000 Standard Occupational Classification (SOC) codes using standard code lists [14-16]. These NAICS codes were used to create 20 broad industry sector groups and the SOC codes were used to create 22 broad occupation groups, as well as to identify specific HCP industry and occupation categories of interest for this report (there are a total of 23 broad SOC occupational groups, but SOC 55 which includes military specific occupations is not included in the analysis of broad SOC groups as there is no equivalent occupation code for military personnel of unknown rank) [17].

[1]California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

[2]Centers for Disease Control and Prevention [CDC], Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2013. Source: http://www.cdc.gov/brfss/questionnaires/index.htm). Data from Wyoming Department of Health, Public Health Division, Behavioral Risk Factor Surveillance System, were supported in part by CDC Cooperative Agreement, U58/SO000016-1 through 3 [2011-2013]. Data from Washington State Department of Health, Center for Health Statistics, Behavioral Risk Factor Surveillance System were supported in part by CDC Cooperative Agreement, U58/SO000047-1 through 3 [2011-2013]).

Tier 1 groups for allocating pandemic influenza vaccines were defined using NAICS, SOC, and Census codes for the following groups: deployed and mission critical personnel who have an essential role in national security and have a high risk of influenza exposure due to living conditions and geographic location; inpatient healthcare providers who play a critical role in caring for the sickest persons and have a high risk of exposure; outpatient and home health providers whose care is critical to decrease the burden on hospitals and also have a high risk of exposure; emergency services sector personnel who provide critical medical care and have increased risk of aerosol exposure as well as law enforcement and fire services personnel; and other groups such as healthcare providers in long term care facilities, manufacturers of pandemic vaccine and antivirals, and public health personnel [10]. Since the BRFSS does not sample deployed military personnel, this Tier 1 category was based on military personnel living in residential or college housing. Healthcare personnel in the Tier 1 groups included only clinical support occupations (physicians/surgeons, nurses, other health diagnosing and treating practitioners, health technologists/technicians, health care support occupations), since the guidance on pandemic vaccine allocation from HHS and DHS describes the critical role of medical care within these occupations [10]. Also, manufacturers of pandemic vaccine and antivirals are considered a Tier 1 group to receive priority for vaccination, but the category included in this study includes any person employed in the "Pharmaceuticals and medicines" industry. Additional analyses were performed on a larger set of healthcare personnel recommended by the ACIP to receive influenza vaccination, which included both clinical and nonclinical healthcare personnel who worked in hospitals, outpatient care/physician offices, long-term care, or other clinical settings; a combination of NAICS and SOC codes were used to define HCP by setting and occupation. In these analyses, influenza vaccination coverage estimates were calculated for healthcare personnel overall, by demographic and access-to-care characteristics, and by specific healthcare occupation and setting. When reporting by specific healthcare industry, individual NAICS codes were used, while SOC codes were used to report by individual healthcare occupations (e.g., physicians, nurses).

Respondents who reported receiving an influenza shot or vaccine that was sprayed in the nose at any time in the 12 months preceding their interview were defined as having been vaccinated for influenza. Of the 87,591 employed respondents with an available NAICS code, 917 (1.0%) were excluded because they did not have a "yes" or "no" response to the question on receipt of influenza vaccine, while 929 (1.1%) of the 88,476 employed respondents with an available SOC code were excluded for this reason. The percentage of respondents who reported influenza vaccination in the past 12 months was calculated using a simple weighted proportion because the purpose was not to estimate season-specific influenza vaccination coverage as has been reported previously using Kaplan Meier methods [18]. T-tests were used to make comparisons between groups with a significance level set at $\alpha = 0.05$. All analyses were performed using SAS version 9.3 and SUDAAN version 11.0.

Results

Over the 20 broad industry sectors in Table 1, influenza vaccination coverage ranged from 18.7% among workers in the construction industry to 52.6% among workers in management

of companies and enterprises. Over the 22 broad occupational groups in Table 2, influenza vaccination coverage was lowest among the farming, fishing, and forestry occupations (13.7%) and highest among healthcare practitioners and technical occupations (62.3%).

Among the industries and occupations classified as Tier 1, influenza vaccination coverage was 56.1% among all Tier 1 groups combined; 66.5% among deployed and mission critical personnel; 48.5% among public health personnel; 67.4% among inpatient healthcare providers; 54.5% among outpatient and home health providers; 48.4% among healthcare providers in long-term care facilities; 36.5% among emergency services sector personnel; and 37.7% among manufacturers of pharmaceuticals and medicines (including pandemic vaccine and antivirals) (Table 3).

When each non-HCP Tier 1 group was compared with each health care Tier 1 group, non-HCP Tier 1 groups had significantly lower influenza vaccination coverage ($p<0.05$ by T-test) than health care Tier 1 groups with a few exceptions. When comparing inpatient health care providers with deployed and mission critical personnel, public health personnel with outpatient and home health providers, public health personnel with providers in long term care facilities, and manufacturers of pandemic vaccine and antivirals with providers in long term care facilities, influenza vaccination coverage rates were similar ($p= 0.79$, 0.18, 0.98, and 0.09, respectively) (Table 3).

Among all HCP, influenza vaccination coverage was 55.1%, while only 29.7% of non-HCP were vaccinated (Table 4). Among HCP and non-HCP, those with higher education, higher annual household income, a personal healthcare provider, and health insurance had statistically significantly higher influenza vaccination coverage compared with the reference groups. Influenza vaccination coverage was lower among non-Hispanic blacks and Hispanics compared with whites among HCP and non-HCP (Table 4).

Compared with all other HCP occupations, physicians and surgeons had significantly higher influenza vaccination coverage (75.8%). Influenza vaccination coverage was higher among workers in hospitals (65.5%) than among workers in outpatient care centers/physician offices (52.8%), other clinical settings (46.7%), and long-term care facilities (41.6%) (Table 5).

Influenza vaccination among Tier 1 occupations and industries and among HCP varied by state. Among persons employed in Tier 1 occupations or industries, influenza coverage ranged from 43.3% in Florida to 68.7% in Minnesota with a median of 57.1%. Among HCP, influenza vaccination coverage ranged from 41.1% in Florida to 69.5% in North Dakota with a median of 56.3% (Data on state-based vaccination coverage rates are available to readers upon request).

Discussion

Influenza vaccination coverage varied widely by industry and occupation. Compared with the 2009-10 influenza season [19], the broad industry and occupation categories with the highest and lowest seasonal influenza vaccination coverage in this study were similar, although different analytic approaches were used to estimate coverage. Besides the

healthcare and social assistance industry, the public administration industry had high influenza coverage in this study and in the 2009-10 season, while the construction industry had among the lowest [19]. Additionally, influenza vaccination coverage was less than 30% among some occupations with frequent contact with the public, such as food preparation and serving, sales, personal care and service occupations even though there have been relatively high rates of influenza-like illness documented in these occupations [19]. Vaccination coverage among non-HCP within the highest household income level is significantly lower than HCP in the same income strata, indicating that within non-HCP occupations or industries, having higher income alone is not enough to achieve coverage rates comparable to HCP. Influenza vaccination has been shown to be cost-effective and inexpensive for large employers and offering vaccination in workplaces where coverage is low may increase coverage rates in these groups [20]. Access-based workplace interventions such as vaccination promotion materials, on-site vaccination events, and free vaccinations for employees increased influenza vaccination rates among restaurant employees [21]. Also, the Community Preventive Services Task Force recommends interventions with on-site, reduced cost, and actively promoted influenza vaccinations for non-HCP, and also recommends interventions with on-site, free, and actively promoted influenza vaccinations for HCP [22]. In a 2012 survey of large U.S. companies, most offered on-site vaccination, although fewer than half reported offering access to vaccination at all worksites within the company [20].

Findings from this report were similar to previous studies on demographic and access to care factors related to influenza vaccination in the general population [23, 24] and among HCP [25], including racial and ethnic vaccination differences. In particular, vaccination coverage among HCP with a personal care provider and health insurance was higher than among HCP without a personal provider or insurance [25]. In the general population, higher education, having health insurance and a usual place for health care, and having one or more physician visits in the previous year were independently associated with receipt of these vaccines [23, 24]. Differences in attitudes toward vaccination, vaccine-seeking behaviors, likelihood of a provider recommendation, quality of care received, as well as other factors might contribute to racial and ethnic vaccination differences [23, 24, 26-30].

Persons in healthcare occupations had the highest influenza vaccination coverage of all broad occupations. Higher coverage rates in these groups could in part be due to workplace vaccination requirements, promotions in healthcare settings, or employers making vaccination available at the workplace at no cost for multiple days. Offering vaccines on-site, free of charge, and actively promoting influenza vaccination has been shown to be effective in increasing influenza vaccination coverage among HCP and in decreasing cases of influenza among HCP and patients when implemented alone or as a part of a multicomponent intervention [22]. According to an internet panel survey from the 2013-14 influenza season, about 74% of HCP reported that their workplace either required or promoted influenza vaccination [31]. Requirements were highest in hospital settings, which also had the highest reported coverage rates, which might be due to the Centers for Medicare and Medicaid Services (CMS) requirement in place since January 2013 to report HCP influenza vaccination levels as part of its hospital quality reporting programs [31, 32]. Despite having high coverage rates among the broad industries and occupations in this study, only about half of persons in the healthcare and social assistance industry reported influenza

vaccination. In certain specific occupations or industry settings, such as healthcare support occupations or long-term care facilities, coverage was even lower. HCP in long-term care facilities have been most likely to report that their employer neither required nor promoted influenza vaccination and least likely to report that their employer made influenza vaccination available at no cost for multiple days [31]. While vaccination requirements have been associated with higher influenza vaccination coverage, offering vaccination on-site, at no cost, and actively promoting vaccination might also improve vaccination among HCP [22, 31].

Among Tier 1 target groups, slightly more than half of all persons were vaccinated for influenza. Overall, influenza vaccination coverage rates among Tier 1 target groups were similar to 2009-10 seasonal influenza coverage rates previously published for non-Tier 1 target groups in broader industries [19]. Based on this previous study, H1N1 influenza vaccination coverage rates were lower than the seasonal coverage rates for each industry/occupation [19]. Increasing coverage among these target groups may prevent disruption in products and services in healthcare, emergency services, national security, and other sectors during a pandemic [10]. Using vaccine allocation strategies tailored to the specific event, such as factoring in the event-specific disease virulence, vaccine production rates, and public demand, would also be an important consideration during a pandemic [33]. Such tailored strategies would need to be developed.

Wide variation in state influenza vaccination was observed among Tier 1 occupations and HCP among the 21 states for which industry/occupation data were available. Some states with the lowest and highest influenza coverage had relatively low or high vaccination coverage rates among the general population in recent seasons [34]. Variation in state coverage could be due to differing medical care delivery infrastructure, population norms, and effectiveness of state and local immunization programs among states [35].

There were several limitations to this study. First, respondents with vague responses and those who refused to answer the I/O questions (17-18%) were excluded from industry and occupation estimations, creating a potential for bias. In contrast, the prevalence of “don't know” or refused responses from the National Health Interview Survey, an in-person survey, was about 2% in 2015 for the industry/occupation questions [36]. Second, industry and occupation codes used to identify Tier 1 groups were broadly based, and it is possible that some workers who should be classified as Tier 2 were included in our estimates of Tier 1 groups. During an actual pandemic event, this could be resolved by specifying occupational codes within the relevant industries (for example, specific occupations within the “national security and international affairs/DOD” category), although these selected occupations may vary depending on particular needs during a specific pandemic. Based on lessons learned from the 2009 H1N1 pandemic vaccination campaigns, 35% of immunization program managers stated that during a future pandemic event similar to the 2009 H1N1 influenza pandemic, they would change their vaccination allocation strategy, including specifying whether health care personnel includes fire and police personnel, school nurses, or even teachers [33]. Additionally, the BRFSS does not collect information from deployed military personnel, so estimates for this occupational group were based on a small number of military personnel sampled by BRFSS who lived in residential or college housing. Third, influenza

vaccination status was based on self-report and therefore subject to recall bias. However, self-reported seasonal influenza vaccination has been shown to have relatively high agreement with vaccination status from medical records [37-40]. Additionally, only seasonal influenza vaccination was estimated and generalized for pandemic planning; rates from seasonal influenza may provide an idea of groups needing improvement and the relative rates of influenza vaccination for various industry and occupational groups. Finally, response rates were low; although the median state response rate was 44%, in some states the response rate was as low as 31%. A low response rate can result in nonresponse bias if respondents and nonrespondents differ in their vaccination rates, and survey weights are not able to fully account for such differences.

Conclusion

Influenza vaccination can reduce transmission of influenza disease among workers. This report documents the particular industries and occupations where improvement in vaccination is needed. Prior to a pandemic event, more specificity on occupational codes to define exact industries and occupations in each Tier group would be beneficial in implementing pandemic influenza vaccination programs and monitoring the success of these programs, as broad labeling of these categories creates difficulty in distinguishing Tier 1 versus Tier 2 individuals within the same industry.

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Table 1

Influenza vaccination coverage by industry of employment among workers ≥18 years – Behavioral Risk Factor Surveillance System – 2013, 21 States*

Industry sector (2002 NAICS code)	n	%† (95% CI)
Management of companies and enterprises (NAICS 55)	161	52.6 (34.2-70.3)
Healthcare and social assistance (NAICS 62)	15,574	52.4 (50.7-54.0)
Public administration (NAICS 92)	7,090	44.6 (42.4-47.0)
Educational services (NAICS 61)	10,818	37.8 (35.8-39.7)
Professional, scientific, and technical services (NAICS 54)	5,631	34.8 (32.6-37.1)
Information (NAICS 51)	1,967	33.8 (29.9-37.9)
Finance and insurance (NAICS 52)	4,111	33.0 (30.1-36.2)
Real estate and rental and leasing (NAICS 53)	1,787	31.8 (27.4-36.6)
Utilities (NAICS 22)	962	31.8 (26.2-37.9)
Manufacturing (NAICS 31-33)	5,362	30.6 (28.3-32.9)
Retail trade (NAICS 44-45)	5,782	27.5 (25.3-29.9)
Arts, entertainment, and recreation (NAICS 71)	1,733	27.2 (22.7-32.1)
Other services (except public administration) (NAICS 81)	4,606	26.7 (24.1-29.5)
Transportation and warehousing (NAICS 48-49)	3,300	25.6 (22.7-28.7)
Administrative and support and waste management and remediation services (NAICS 56)	2,527	24.6 (21.6-27.8)
Wholesale trade (NAICS 42)	1,259	24.5 (20.3-29.3)
Mining, quarrying, and oil and gas extraction (NAICS 21)	1,307	23.8 (19.4-28.8)
Agriculture, forestry, fishing, and hunting (NAICS 11)	3,298	21.9 (18.2-26.1)
Accommodation and food services (NAICS 72)	3,812	21.3 (18.8-24.1)
Construction (NAICS 23)	5,587	18.7 (16.9-20.6)

Abbreviations: NAICS=North American Industry Classification System (http://www.census.gov/eos/www/naics/); CI=confidence interval.

*California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

†Weighted proportion of respondents who reported receiving an influenza vaccine in the past 12 months.

Table 2

Influenza vaccination coverage by occupation among workers ≥18 years – Behavioral Risk Factor Surveillance System – 2013, 21 States*

Occupational group (2000 SOC major group†)	n	%‡ (95% CI)
Healthcare practitioners and technical occupations (SOC 29)	7,317	62.3 (60.0-64.5)
Legal occupations (SOC 23)	1,243	46.1 (41.5-50.9)
Life, physical, and social science occupations (SOC 19)	1,563	45.6 (40.8-50.5)
Healthcare support occupations (SOC 31)	2,199	42.2 (37.9-46.6)
Business and financial operations occupations (SOC 13)	3,941	40.6 (37.5-43.7)
Education, training, and library occupations (SOC 25)	7,319	38.8 (36.7-41.0)
Community and social services occupations (SOC 21)	2,048	38.3 (34.1-42.6)
Computer and mathematical occupations (SOC 15)	2,516	38.2 (34.7-41.7)
Architecture and engineering occupations (SOC 17)	2,320	35.0 (31.6-38.6)
Management occupations (SOC 11)	9,971	34.6 (32.8-36.4)
Office and administrative support occupations (SOC 43)	10,576	32.4 (30.6-34.3)
Arts, design, entertainment, sports, and media occupations (SOC 27)	2,011	31.7 (28.0-35.7)
Protective service occupations (SOC 33)	1,777	31.5 (27.5-35.8)
Personal care and service occupations (SOC 39)	2,939	29.3 (26.0-32.9)
Building and grounds cleaning maintenance occupations (SOC 37)	3,179	27.5 (24.2-31.1)
Sales and related occupations (SOC 41)	8,110	27.3 (25.4-29.3)
Production occupations (SOC 51)	3,771	25.1 (22.6-27.8)
Installation, maintenance, and repair occupations (SOC 49)	2,587	24.8 (21.5-28.5)
Transportation and material moving occupations (SOC 53)	3,954	23.9 (21.2-26.9)
Food preparation and serving related occupations (SOC 35)	2,823	21.9 (18.8-25.2)
Construction and extraction occupations (SOC 47)	4,603	18.8 (16.6-21.3)
Farming, fishing, and forestry occupations (SOC 45)	780	13.7 (9.7-18.9)

Abbreviations: SOC=Standard Occupation Classification (http://www.bls.gov/soc/); CI=confidence interval.

[a] California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

† SOC 55 is not included because coding of military personnel was not compatible with the SOC coding scheme.

‡ Weighted proportion of respondents who reported receiving an influenza vaccine in the past 12 months.

Table 3

Influenza vaccination coverage by Tier 1 occupational groups[*] among workers ≥18 years – Behavioral Risk Factor Surveillance System – 2013, 21 States[†]

Tier 1 target group	2002 NAICS/2002 Census/2000 SOC description (NAICS/Census/SOC code)	n	%[‡] (95% CI)
Total	All codes below	10,256	56.1 (54.1-58.1)
Deployed and mission critical personnel[§]	National Security and International Affairs/DOD (NAICS 928 and Census 9590)[‖], Army, Air Force, Navy, Marines, U.S. Coast Guard, unknown military branch (NAICS 928110 excluding Census 9870)	905	66.5 (59.8-72.5)
Public health personnel	Administration of human resource programs[¶] (NAICS 923)	612	48.5 (40.8-56.3)
Inpatient health care providers	Hospitals[**] (NAICS 622)	3,417	67.4 (64.2-70.5)
Outpatient and home health providers	Outpatient care centers[**] (NAICS 6214), physician offices[**] (NAICS 6211), health practitioner offices[**,††] (NAICS 6213[‡‡]), home health care services[**] (NAICS 6216)	2,985	54.5 (50.5-58.5)
Healthcare providers in long term care facilities	Nursing care facilities[**] (NAICS 6231)	910	48.4 (41.0-55.8)
Emergency services sector personnel	Other healthcare services (emergency medical technicians, paramedics) (NAICS 621 and SOC 29-2041), justice, public order, and safety activities (protective service) (NAICS 922, 92115 and SOC 33)	1,169	36.5 (31.2-42.2)
Manufacturers of pandemic vaccine and antivirals	Pharmaceuticals and medicines (NAICS 3254)	258	37.7 (28.3-48.0)

Abbreviations: NAICS=North American Industry Classification System (http://www.census.gov/eos/www/naics/); SOC=Standard Occupation Classification (http://www.bls.gov/soc/); CI=confidence interval.

[*] Tier 1 occupational groups are defined by the U.S. Department of Health and Human Services and Department of Homeland Security which include the following groups: deployed and mission critical personnel who have an essential role in national security and have a high risk of influenza exposure due to living conditions and geographic location; inpatient healthcare providers who play a critical role in caring for the sickest persons and have a high risk of exposure; outpatient and home health providers whose care is critical to decrease the burden on hospitals and also have a high risk of exposure; emergency services sector personnel who provide critical medical care and have increased risk of aerosol exposure; and other groups such as healthcare providers in long term care facilities, manufacturers of pandemic vaccine and antivirals, and public health personnel.

[†] California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

[‡] Weighted proportion of respondents who reported receiving an influenza vaccine in the past 12 months.

[§] The Tier 1 definition is "deployed military and mission critical personnel" but BRFSS excludes military personnel deployed or living in military housing. Military personnel living in residential or college housing in the United States are included.

[‖] May include national security and international affairs (DOD) from Tier 2 (essential support and sustainment personnel, intelligence services, border protection personnel, other domestic national security personnel, or other active duty and essential support).

[¶] City, state, and federal health departments, including the Centers for Disease Control and Prevention.

** Restricted to physicians/surgeons, nurse practitioners/nurses, other health diagnosing and treating practitioners, health technologists/technicians, and healthcare support occupations working in these industries.

†† Medical labs, blood banks, dialysis centers, MRI centers.

Excludes NAICS 62131 and 62132.

Table 4

Influenza vaccination coverage by healthcare personnel status, demographic and access to care characteristics among workers ≥18 years – Behavioral Risk Factor Surveillance System – 2013, 21 States*

Characteristic	Healthcare personnel†		Non-healthcare personnel‡	
	n	%§ (95% CI)	n	%§ (95% CI)
Total	13,610	55.1 (53.4-56.9)	73,064	29.7 (29.0-30.4)‖
Age				
18-49¶	6,730	52.5 (50.1-54.9)	36,142	24.6 (23.8-25.5)‖
50-64	5,623	59.5 (56.8-62.2)**	29,364	36.3 (35.1-37.5)‖,**
65+	1,257	58.7 (53.2-63.9)**	7,558	53.3 (50.7-55.9)**
Sex				
Male¶	2,807	54.7 (50.9-58.6)	37,442	27.4 (26.5-28.3)‖
Female	10,803	55.3 (53.3-57.2)	35,622	32.9 (31.9-34.0)‖,**
Race/ethnicity				
White, non-Hispanic¶	10,668	58.8 (57.0-60.6)	58,459	32.1 (31.4-32.8)*
Black, non-Hispanic	1,226	39.7 (34.9-44.8)**	4,324	23.1 (20.9-25.5)‖,**
Hispanic	806	46.3 (39.6-53.1)**	5,618	25.3 (23.2-27.5)‖,**
Other, non-Hispanic	767	65.6 (58.0-72.4)	3,735	29.6 (26.5-32.8)‖
Education				
Less than high school¶	304	37.3 (28.9-46.7)	3,553	22.8 (20.2-25.5)‖
High school graduate/GED	2,090	50.9 (46.5-55.3)**	18,171	24.8 (23.5-26.1)‖
Some college/technical school	4,296	52.2 (49.1-55.4)**	20,182	27.5 (26.4-28.8)‖,**
College graduate	6,912	61.2 (58.8-63.6)**	31,064	38.5 (37.5-39.6)‖,**
Income				
<$20K¶	963	33.4 (28.1-39.1)	6,860	20.1 (18.3-22.0)‖
$20K-<$50K	3,783	48.0 (44.8-51.3)**	20,963	24.9 (23.6-26.2)‖,**
$50K-<$75K	2,367	55.2 (50.8-59.6)**	12,708	30.8 (29.1-32.5)‖,**
$75K+	5,555	64.5 (61.8-67.1)**	27,088	37.1 (36.0-38.2)‖,**
High-risk conditions††				
Yes	3,286	57.4 (53.8-61.0)	16,545	39.1 (37.5-40.7)‖,**
No¶	10,228	54.4 (52.4-56.4)	55,823	27.5 (26.8-28.3)‖
Have personal healthcare provider				
Yes	11,790	58.6 (56.7-60.5)**	56,882	35.0 (34.2-35.8)‖,**
No¶	1,803	35.4 (31.2-39.7)	15,971	15.4 (14.3-16.6)‖
Have medical insurance				
Yes	12,422	58.4 (56.6-60.2)**	62,902	33.8 (33.0-34.5)‖,**

Characteristic	Healthcare personnel†		Non-healthcare personnel‡	
	n	%§ (95% CI)	n	%§ (95% CI)
No¶	1,167	30.0 (24.9-35.7)	9,947	12.6 (11.4-13.9)‖

Abbreviations: CI=confidence interval; NA=not applicable.

*California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

†Clinical and nonclinical staff working in hospitals (NAICS 622), outpatient care/physician offices (NAICS 6214, 6211), long-term care facilities (NAICS 6216, 6231, 6232, 6233, 6239), other clinical settings (NAICS 6212, 62131, 62132, 6213, 6215, 6219).

‡Other employed adults not classified as healthcare personnel.

§Weighted proportion of respondents who reported receiving an influenza vaccine in the past 12 months.

‖p <0.05 by t-test for comparisons between healthcare personnel and non-healthcare personnel within each level of each characteristic.

¶Reference level.

**p <0.05 by t-test for comparisons within each variable with the indicated reference level†† Adults who reported having at least one or more than one of the following: asthma, diabetes, myocardial infarction, angina or coronary heart disease, chronic obstructive pulmonary disease, emphysema or chronic bronchitis, or cancer (excluding skin cancer).

Table 5

Influenza vaccination coverage by healthcare occupation and occupational setting among healthcare personnel ≥18 years – Behavioral Risk Factor Surveillance System – 2013, 21 States*

Occupation/occupational setting (2000 SOC code/2002 NAICS code)	n	%† (95% CI)
Occupation	13,610	55.1 (53.4-56.9)
Physicians/surgeons (SOC 29-1060)	732	75.8 (69.7-81.0)
Nurse practitioners/registered nurses (SOC 29-1111)	3,208	**67.8 (64.6-70.9)‡**
Other health diagnosing and treating practitioners§ (SOC 29-1000‖)	914	**51.2 (43.9-58.5)‡**
Health technologists/technicians¶ (SOC 29-2000**)	1,262	**59.6 (54.2-64.7)‡**
Healthcare support occupations†† (SOC 31-0000‡‡)	1,874	**45.3 (40.6-50.1)‡**
Non-clinical occupations (All other SOC§§)	5,620	**49.9 (47.3-52.6)‡**
Healthcare industry setting		
Hospitals (NAICS 622)	5,319	65.5 (62.9-68.0)
Outpatient care centers/physician offices (NAICS 6214, 6211)	4,559	**52.8 (49.6-56.0)‖‖**
Long-term care facilities¶¶ (NAICS 6216, 6231, 6232, 6233, 6239)	2,562	**41.6 (37.6-45.6)‖‖**
Other clinical settings*** (NAICS 6212, 62131, 62132, 6213, 6215, 6219)	1,170	**46.7 (40.8-52.7)‖‖**

Note: Boldface indicates statistical significance.

Abbreviatons: SOC=Standard Occupation Classification (http://www.bls.gov/soc/); NAICS=North American Industry Classification System (http://www.census.gov/eos/www/naics/); CI=confidence interval.

*California, Florida, Illinois, Louisiana, Missouri, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oregon, Utah, Washington, Wisconsin, Wyoming.

†Weighted proportion of respondents who reported receiving an influenza vaccination in the past 12 months.

‡p <0.05 by t-test for comparisons within occupation with physicians/surgeons as the reference level.

§Including chiropractors, dentists, dieticians, nutritionists, optometrists, pharmacists, physician assistants, podiatrists, therapists (audiologists, occupational therapists, physical therapists, radiation therapists, recreational therapists, respiratory therapists, speech-language pathologists, and other therapists), and other health diagnosing and treating practitioners.

‖Excluding SOC 29-1060, 29-1111, 29-1131.

¶Including clinical laboratory technologists/technicians, dental hygienists, diagnostic related technologists/technicians, emergency medical technicians and paramedics, health diagnosing and treating practitioner support technicians, medical records and health information technicians, opticians, and other health technologists and technicians.

**Excluding SOC 29-2056.

††Including nursing, psychiatric, and home health aides, occupational and physical therapist assistants and aides, massage therapists, dental assistants, medical assistants, etc.

‡‡Excluding SOC 31-9096.

§§Includes all other occupations who work in HCP settings (hospitals, outpatient care/physician offices, long-term care facilities, other clinical settings).

‖‖p <0.05 by t-test for comparisons within occupational setting with hospitals as the reference level.

¶¶Including home health care services, nursing care facilities, and residential care facilities (without nursing).

***Including dentist, chiropractor, optometrist, and other health practitioner offices; other health care services.