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Major Article

Workplace interventions associated with influenza vaccination coverage among health care personnel in ambulatory care settings during the 2013-2014 and 2014-2015 influenza seasons

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Key Words:
Health care worker
Vaccine

Background: Vaccination of health care personnel (HCP) can reduce influenza-related morbidity and mortality among HCP and their patients. This study investigated workplace policies associated with influenza vaccination among HCP who work in ambulatory care settings without influenza vaccination requirements.
Methods: Data were obtained from online surveys conducted during April 2014 and April 2015 among nonprobability samples of HCP recruited from 2 preexisting national opt-in Internet panels. Respondents were asked about their vaccination status and workplace policies and interventions related to vaccination. Logistic regression models were used to assess the independent associations between each workplace intervention and influenza vaccination while controlling for occupation, age, and race or ethnicity.
Results: Among HCP working in ambulatory care settings without a vaccination requirement (n = 866), 65.7% reported receiving influenza vaccination for the previous influenza season. Increased vaccination coverage was independently associated with free onsite vaccination for 1 day (prevalence ratio [PR], 1.38; 95% confidence interval [CI], 1.07-1.78 or >1 day PR, 1.58; 95% CI, 1.29-1.94) and employers sending personal vaccination reminders (PR, 1.20; 95% CI, 0.99-1.46). Age ≥65 years (PR, 1.30; 95% CI, 1.07-1.56) and working as a clinical professional (PR, 1.26; 95% CI, 1.06-1.50) or clinical nonprofessional (PR, 1.28; 95% CI, 1.03-1.60) were also associated with higher coverage. Vaccination coverage increased with increasing numbers of workplace interventions.
Conclusions: Implementing workplace vaccination interventions in ambulatory care settings, including free onsite influenza vaccination that is actively promoted, could help increase influenza vaccination among HCP.
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Influenza causes significant morbidity and mortality each year.[1-5] Health care personnel (HCP) can acquire influenza in the work setting and transmit influenza to patients at risk for influenza-related complications or death.[6] In previous studies, influenza vaccination of HCP has been shown to reduce the risk of influenza illness and absenteeism in vaccinated HCP[7,8] and to reduce the risk of respiratory illness and deaths in nursing home residents.[9,10] The Advisory Committee on Immunization Practices recommends that all HCP receive an annual influenza vaccination due to the potential to reduce influenza-related morbidity and mortality among HCP and high-risk patients.[6] According to data from the National Health Interview Survey (NHIS), influenza vaccination coverage among HCP has

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improved from <50% before the 2009-2010 influenza season to 68.6% during the 2014-2015 season.[11,12] However, coverage remains well below the national Healthy People 2020 target of 90%.[13] Similarly, estimates from Internet panel surveys conducted by the Centers for Disease Control and Prevention reported that influenza vaccination coverage among HCP increased from 63.5% in the 2010-2011 season to 75.2% in 2013-2014, but remained stable between the 2013-2014 and 2015-2016 seasons.[14]

Reported influenza vaccination coverage has reached as high as 98% among HCP who are subject to an employer requirement for vaccination,[15-17] although vaccination mandates have met resistance from HCP.[15,18-22] Previous studies show providing flexible access to free vaccination at the worksite, offering gift incentives for vaccination, educating HCP about the risk of influenza and the overall benefits of influenza vaccination, requiring employees to sign a declination form if not vaccinated, and imposing penalties such as requiring nonvaccinated HCP to wear a mask, have been associated with increased influenza vaccination uptake among HCP.[11,23-27] However, the results are inconsistent across studies and the majority have focused on HCP working in hospital settings,[24,27] leaving a gap in knowledge of effective interventions in ambulatory care settings where approximately 30% of US-based HCP work.[28] The purpose of this study was to investigate workplace interventions associated with increased influenza vaccination coverage among HCP working in ambulatory care settings without employer vaccination requirements.

METHODS

Study sample

Data were analyzed from 2 online surveys of HCP conducted for the Centers for Disease Control and Prevention by Abt Associates, Inc (Cambridge, MA) during April 2014 and April 2015. For both surveys, a convenience sample of HCP was recruited from 2 preexisting national opt-in Internet panels, Medscape and Survey Sampling International (SSI) (Shelton, CT). Survey participants in clinical occupations (excluding assistants and aides) were recruited from a list of members of WebMD Professional Network's professional health Web site (Medscape.com). Medscape has approximately 2 million US health care professional members, including physicians, nurses, allied health practitioners, and clinical technical professionals. A general population Internet panel operated by SSI (https://www.surveysampling.com/) was used to recruit additional health care occupations, including assistants and aides, administrative support staff and managers, and nonclinical support staff. Medscape and SSI panel members aged 18 years and older and living in the United States were invited to participate in the surveys via e-mail invitations and Web site messages.

Respondents were eligible for the surveys if they reported any patient contact or reported working in at least 1 of 8 health care settings (hospital; physician's office or other ambulatory care setting; dentist office or dental clinic; pharmacy; nursing home, assisted living facility, or other long-term care facility; home health agency or home health care; emergency medical service, ambulance, or other patient transport; or other health care settings); respondents could report working in multiple settings. A total of 3,906 eligible respondents completed the surveys. The current analysis is restricted to respondents who indicated that they worked in an ambulatory care setting, defined in the survey as a "physician's office or other non-hospital setting, such as any medical clinic, urgent care, or any other outpatient or ambulatory care setting." Of the 1,395 respondents who reported working in an ambulatory care setting, 529 (37.9%) were excluded because they reported that their employer in any of the settings in which they worked required them to be vaccinated, leaving a final analytic sample of 866.

The surveys were designed to provide end-of-season estimates of influenza vaccination coverage and vaccine-related knowledge, attitudes, and behaviors among HCP. A copy of the survey instrument is shown in the Appendix. Survey items included occupation, age, sex, education, race or ethnicity, work setting, self-reported vaccination status for the respective influenza season (vaccinated since July 2013 for those surveyed during April 2014 and since July 2014 for those surveyed during April 2015), workplace vaccination policies and interventions (including vaccination requirements and vaccination availability at the workplace), and promotion of vaccination (including educational activities; recognition, rewards, or compensation for vaccination; penalties for nonvaccination; personal reminders to be vaccinated; and free or subsidized vaccination).

Respondents could report working in more than 1 work setting, and 145 of respondents included in this analysis reported working in at least 1 other setting in addition to an ambulatory care setting. The workplace vaccination interventions included in this analysis were those reported for any setting where the respondent worked. Occupation was classified as clinical professional (physicians, dentists, nurse practitioners, physician assistants, nurses, allied health professionals, pharmacists, and students in a medical-related field), clinical nonprofessional (technicians and technologists, paramedics, emergency medical technicians, and assistants and aides), and nonclinical support staff (administrative support staff/managers, housekeeping and foodservice staff, and other nonclinical support staff).

Data were weighted to the US population of HCP by work setting, occupation, race or ethnicity, gender, age, and geographic region. A poststratification weight for each responding person in the survey was developed through raking using the most recent Bureau of Labor Statistics Occupational Employment and Wage Estimates[29,30] and Current Population Survey data.[31,32]

Statistical analysis

All analyses include combined data from the 2014 and 2015 surveys (N = 866 survey respondents). Logistic regression models were used to assess the unadjusted and adjusted prevalence ratios (aPR) and corresponding 95% confidence intervals (CIs) for the association of influenza vaccination with each workplace intervention as well as demographic and workplace characteristics thought a priori to be associated with vaccination coverage. Adjusted prevalence ratios were obtained from a multivariable model containing variables for each workplace intervention, occupation, age, and race or ethnicity (model I). A second multivariable model was constructed that used a composite variable for the total number of workplace interventions (0, 1, 2, or ≥3 interventions) instead of the variables for each individual intervention, occupation, age, and race/ethnicity (model II). Education was not included in the multivariable models due to potential collinearity with the occupation variable. Workplace interventions reported by fewer than 30 respondents were excluded from the multivariable models. Analyses were conducted using SUDAAN version 11 (Research Triangle Institute, Research Triangle Park, NC). P values < .05 were considered to be statistically significant. Statistical measures were calculated using the assumption of random sampling.

RESULTS

Table 1 presents the distribution of the study population by occupation, demographic characteristics, and presence of workplace vaccination interventions. The majority of respondents were aged 18-49 years (65.0%), women (76.9%), had a college education or

Table 1
Distribution of occupation, demographic characteristics, and influenza vaccination-related workplace interventions among health care personnel (HCP) working in an ambulatory care setting without employer vaccination requirements. Internet panel surveys, United States, 2013-2014 and 2014-2015 influenza seasons

HCP characteristic/workplace intervention	Unweighted n	Weighted % (95% confidence interval)
Total	866	100
Occupation		
Clinical professional*	615	45.6 (40.7-50.4)
Clinical nonprofessional†	83	14.2 (10.7-17.7)
Non-clinical support staff‡	168	40.3 (35.2-45.4)
Age (y)		
18-49	487	65.0 (60.7-69.4)
50-64	316	28.2 (24.2-32.2)
≥65	63	6.8 (4.6-9.0)
Sex		
Male	292	23.1 (18.9-27.4)
Female	574	76.9 (72.6-81.1)
Education		
Less than college	193	40.8 (35.8-45.8)
College	151	29.6 (24.7-34.4)
More than college	522	29.6 (25.7-3.5)
Race or ethnicity		
White, non-Hispanic	516	66.9 (62.2-71.9)
Black, non-Hispanic	114	12.3 (9.0-15.7)
Hispanic	175	13.0 (10.0-16.1)
Other, non-Hispanic	58	7.7 (4.7-10.7)
Region		
Northeast	160	22.3 (17.8-26.7)
Midwest	133	19.3 (15.4-23.3)
South	393	36.2 (31.5-40.8)
West	180	22.2 (18.1-26.3)
Offered onsite vaccination		
For 1 d	180	16.8 (13.1, 20.4)
For >1 d	348	39.0 (34.2, 43.9)
No onsite vaccination	338	44.2 (39.2, 49.1)
Employer publicized risks and benefits of vaccination		
Yes	509	54.1 (49.1-59.1)
No	356	45.9 (40.9-50.9)
Received personal reminder to be vaccinated		
Yes	503	52.9 (48.0-57.9)
No	362	47.1 (42.1-52.0)
Required to sign waiver or declination form if not vaccinated		
Yes	199	21.1 (17.3-25.0)
No	625	78.9 (75.0-82.7)
Employer publicized vaccination coverage level to employees		
Yes	136	17.6 (13.6-21.6)
No	730	82.4 (78.4-86.4)
Financial incentive or rewards		
Yes	25	3.9 (1.6-6.2)
No	841	96.1 (93.8-98.4)
Wear a badge or other visible sign of nonvaccination status		
Yes	36	3.2 (1.7, 4.7)
No	830	96.8 (95.3-98.3)
Total workplace interventions		
0	191	25.4 (21.2-29.7)
1	125	14.6 (11.1-18.2)
2	139	17.0 (13.0-21.0)
≥3	411	42.9 (38.1-47.8)

*Physicians, dentists, nurse practitioners, physician assistants, nurses, allied health professionals, pharmacists, and students in a medical-related field.
†Technicians or technologists, emergency medical technicians, paramedics, and assistants or aides.
‡Administrative support staff/managers, housekeeping and foodservice staff, and other nonclinical support staff.

higher (59.2%), and were non-Hispanic white (66.9%). Approximately 75% of HCP reported at least 1 workplace intervention in any location where they worked. The most commonly reported interventions were employers offering onsite vaccination for at least 1 day (55.8%), employers publicizing the risks and benefits of vaccination (54.1%), and being sent a personal reminder to be vaccinated (52.9%).

Table 2 presents the associations of occupation, demographic characteristics, and workplace interventions with influenza vaccination coverage among HCP working in ambulatory care settings without employer vaccination requirements. Overall, 65.7% of respondents in the analytic sample reported receiving influenza vaccination in the respective influenza season (Table 2). Among those vaccinated, 71.4% reported receiving the vaccination at work (data not shown). In bivariate analysis, higher vaccination coverage was associated with working as a clinical professional, age ≥65 years, being offered onsite vaccination for 1 or more days, being informed of the risks and benefits of vaccination, receiving a personal reminder to be vaccinated, being required to sign a waiver or declination form if not vaccinated, and having an employer who publicized vaccination coverage levels to employees (Table 2). After adjustment for other factors in multivariable analysis, the individual workplace interventions that remained associated with increased coverage were being offered onsite vaccination for 1 day (aPR, 1.38; 95% CI, 1.07-1.78) or >1 day (aPR, 1.58; 95% CI, 1.29-1.94) and receiving a personal reminder to be vaccinated (aPR, 1.20; 95% CI, 0.99-1.46) (model I). However, HCP working in ambulatory care settings with 2 or more interventions of any type were about 2 times more likely to be vaccinated compared with those with no workplace interventions (model II) (aPR, 2.01; 95% CI, 1.57-2.57 for 2 workplace interventions and aPR, 1.92; 95% CI, 1.51-2.44 for ≥3 workplace interventions). Working as a clinical professional or clinical nonprofessional compared with working as nonclinical support staff and age ≥65 years compared with age 18-49 years remained significantly associated with vaccination in both multivariable models (Table 2).

DISCUSSION

Among HCP working in ambulatory care settings without employer vaccination requirements, this study found that access to onsite vaccination and being sent a personal reminder to be vaccinated were independently associated with increased influenza vaccination after controlling for occupation, demographic characteristics, and other workplace interventions. However, whereas both of these interventions alone were associated with modest increases in vaccination coverage, a larger effect was observed with the use of multiple interventions. Vaccination coverage among HCP who reported at least 2 workplace interventions in any location where they worked was about twice that of HCP without any workplace interventions. These results were similar to results from recent review articles on interventions to increase influenza vaccination coverage among HCP that reported that vaccination uptake increases with an increasing number of intervention program components in hospital and nonhospital settings.[24,27,33]

Previous studies of workplace interventions to increase influenza vaccination among HCP have almost exclusively involved evaluating workplace interventions among HCP working within a single or a small number of hospitals or long-term care facilities, using their own facility as a historical control. Few prior studies have evaluated the effect of workplace interventions on vaccination coverage among HCP working in ambulatory care settings. In a randomized controlled trial conducted among employees of primary care clinics in the United Kingdom, Dey et al[34] found that an intense promotional campaign involving educational activities conducted by a visiting public health nurse had no effect on influenza vaccination uptake among HCP. In contrast, Abramson et al[35] reported an increase in influenza vaccination coverage of approximately 26 percentage points among staff from primary care community clinics

Table 2
Influenza vaccination coverage of health care personnel (HCP) working in an ambulatory care setting without employer vaccination requirements, by occupation and demographic characteristics; influenza vaccination-related workplace interventions; and associations of characteristics and workplace interventions with vaccination coverage. Internet panel surveys, United States, 2013-2014 and 2014-2015 influenza seasons

HCP characteristic/workplace intervention	Unweighted n	Weighted % vaccinated	Unadjusted prevalence ratio (95% confidence interval)	Adjusted prevalence ratio (95% confidence interval) (model I)*	Adjusted prevalence ratio (95% confidence interval) (model II)†
Total	866	65.7			
Occupation					
Clinical professional§	615	77.1	1.46 (1.22-1.76)‡	1.26 (1.06-1.50)‡	1.31 (1.10-1.54)‡
Clinical nonprofessional‖	83	66.3	1.26 (0.97-1.63)	1.28 (1.03-1.60)‡	1.30 (1.06,-1.59)‡
Nonclinical support staff¶	168	52.7	Reference	Reference	Reference
Age (y)					
18-49	487	62.8	Reference	Reference	Reference
50-64	316	68.8	1.10 (0.95-1.27)	1.04 (0.90-1.21)	1.05 (0.92-1.20)
≥65	63	81.9	1.31 (1.07-1.59)‡	1.30 (1.07-1.56)‡	1.29 (1.09-1.53)‡
Race/ethnicity					
White, non-Hispanic	516	64.1	Reference	Reference	Reference
Black, non-Hispanic	114	74.0	1.15 (0.95-1.40)	1.06 (0.83-1.36)	1.07 (0.87-1.32)
Hispanic	175	68.1	1.06 (0.87-1.30)	0.96 (0.77-1.21)	0.94 (0.77-1.15)
Other, non-Hispanic	58	67.1	1.05 (0.75-1.46)	1.05 (0.82-1.36)	1.03 (0.78-1.35)
Offered onsite vaccination					
For 1 d	180	75.1	1.63 (1.32-2.03)‡	1.38 (1.07-1.78)‡	
For >1 d	348	84.1	1.83 (1.53-2.19)‡	1.58 (1.29-1.94)‡	
No onsite vaccination	338	46.0	Reference	Reference	
Employer publicized risks and benefits of vaccination					
Yes	509	74.7	1.36 (1.16-1.59)‡	0.98 (0.82-1.16)	
No	356	55.1	Reference	Reference	
Personal reminder to be vaccinated					
Yes	503	78.3	1.52 (1.29-1.79)‡	1.20 (0.99-1.46)‡	
No	362	51.6	Reference	Reference	
Required to sign waiver or declination form if not vaccinated					
Yes	199	83.5	1.39 (1.22-1.59)‡	1.14 (0.94-1.38)	
No	625	60.0	Reference	Reference	
Employer publicized vaccination coverage level to employees					
Yes	136	78.3	1.24 (1.05-1.47)‡	1.04 (0.83-1.29)	
No	730	63.1	Reference	Reference	
Financial incentive or rewards					
Yes	25	50.5	0.76 (0.41-1.41)		
No	841	66.4	Reference		
Wear a badge or other visible sign of nonvaccination status					
Yes	36	100	0.77 (0.60-1.00)	0.77 (0.54-1.10)	
No	830	64.2	Reference	Reference	
Total number of workplace interventions					
0	191	39.9	Reference		Reference
1	125	53.9	1.35 (0.96-1.90)		1.31 (0.95-1.81)
2	139	81.6	2.05 (1.59-2.64)‡		2.01 (1.57-2.57)‡
≥3	411	78.8	1.98 (1.54-2.54)‡		1.92 (1.51-2.44)‡

*Contains variables for individual workplace interventions.
†Contains composite variable for number of workplace interventions.
‡$P < .05$ compared with reference category.
§Physicians, dentists, nurse practitioners, physician assistants, nurses, allied health professionals, pharmacists, and students in a medical-related field.
‖Technicians/technologists; emergency technicians, paramedics, and emergency medical technicians; and assistants or aides.
¶Administrative support staff or managers, housekeeping and foodservice staff, and other nonclinical support staff.

in Israel following implementation of an intervention consisting of educational lectures, personal e-mail reminders, and vaccination advocates who personally approached each staff member. This study is unique in that it is the first to evaluate the association of workplace interventions and influenza vaccination coverage among a sample of HCP working in ambulatory care settings across the United States. This study found that offering onsite vaccination, even for only 1 day, was the single factor most strongly associated with increased vaccination coverage among HCP working in ambulatory care settings. In addition, the majority of vaccinated respondents in the present study reported being vaccinated at work, underscoring the importance of convenient access to vaccination at workplaces in ensuring that HCP are vaccinated. However, larger increases in coverage were associated with exposure to 2 or more workplace interventions. Previously reported data from the same survey indicated that 79.0% of HCP working in ambulatory care settings reported that their employers required, provided, or promoted influenza vaccination, compared with 97.4% of HCP working in hospital settings, suggesting that influenza vaccination is promoted less frequently in ambulatory than in hospital settings.[14] More efforts are needed to promote vaccination and increase vaccination coverage in ambulatory settings.

The findings in this report are subject to several limitations. First, all results in the current survey are based on self-report and might be subject to recall bias. Second, noncoverage and nonresponse bias might remain after weighting adjustments. Third, use of financial incentives or rewards was not evaluated as a possible intervention in multivariable models because only 25 respondents reported receiving this incentive for vaccination. Fourth, the analysis included all respondents who reported working in any ambulatory care setting; the survey could not distinguish independent ambulatory care settings from those affiliated with a hospital or larger health system. Employees working in ambulatory care settings affiliated with a hospital or larger health system might be subject to the vaccination policies of the hospital or health system with which they are affiliated and therefore our results may overstate the influence of the interventions examined on vaccination coverage. Finally, the survey used a nonprobability-based sample of volunteer members of 2 Internet panels and was not randomly selected from HCP in the United States. As such, the results presented here are not generalizable to all US HCP in ambulatory care settings. The sample was weighted to be more representative of the US HCP population; however, estimates of vaccination coverage and interventions might be biased. Estimates of sampling error from nonrandom samples are usually not considered valid.[36] Because the opt-in Internet panel was not a random sample, the statistical measures of associations presented here should be used as guides to implementing interventions that may improve HCP influenza vaccination coverage. In previous influenza seasons, vaccination coverage estimates among HCP from similar Internet panel surveys were higher than those obtained from the population-based sample of HCP in NHIS, although trends in coverage were similar across seasons.[37] The NHIS and other population-based surveys, such as the Behavioral Risk Factor Surveillance System, do not collect information about workplace vaccination practices.

CONCLUSIONS

Use of multiple workplace influenza vaccination interventions was associated with increased influenza vaccination coverage among a national sample of US HCP working in ambulatory care settings without employer vaccination requirements. In the present sample, vaccination coverage of approximately 80% was achieved without an employer requirement for vaccination among HCP reporting at least 2 different vaccine-related workplace interventions. Our results support the Task Force for Community Preventive Services, which recommends interventions with onsite, free, and actively promoted influenza vaccination to increase influenza vaccination among HCP.[38]

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ajic.2017.05.016.

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