

## ORIGINAL ARTICLE

# Voluntary to Mandatory: Evolution of Strategies and Attitudes toward Influenza Vaccination of Healthcare Personnel

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**BACKGROUND.** Assessing the relative success of serial strategies for increasing healthcare personnel (HCP) influenza vaccination rates is important to guide hospital policies to increase vaccine uptake.

**OBJECTIVE.** To evaluate serial campaigns that include a mandatory HCP vaccination policy and to describe HCP attitudes toward vaccination and reasons for declination.

**DESIGN.** Retrospective cohort study.

**METHODS.** We assessed the impact of serial vaccination campaigns on the proportions of HCP who received influenza vaccination during the 2006–2011 influenza seasons. In addition, declination data over these 5 seasons and a 2007 survey of HCP attitudes toward vaccination were collected.

**RESULTS.** HCP influenza vaccination rates increased from 44.0% (2,863 of 6,510 HCP) to 62.9% (4,037 of 6,414 HCP) after institution of mobile carts, mandatory declination, and peer-to-peer vaccination efforts. Despite maximal attempts to improve accessibility and convenience, 27.2% (66 of 243) of the surveyed HCP were unwilling to wait more than 10 minutes for a free influenza vaccination, and 23.3% (55 of 236) would be indifferent if they were unable to be vaccinated. In this context, institution of a mandatory vaccination campaign requiring unvaccinated HCP to mask during the influenza season increased rates of compliance to over 90% and markedly reduced the proportion of HCP who declined vaccination as a result of preference.

**CONCLUSIONS.** A mandatory influenza vaccination program for HCP was essential to achieving high vaccination rates, despite years of intensive vaccination campaigns focused on increasing accessibility and convenience. Mandatory vaccination policies appear to successfully capture a large portion of HCP who are not opposed to receipt of the vaccine but who have not made vaccination a priority.

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There has been longstanding difficulty in achieving high influenza vaccination rates for healthcare personnel (HCP) despite the fact that HCP are at higher risk for exposure to patients with influenza and are potential vectors for exposing high-risk patients to influenza.<sup>1</sup> In the United States, HCP influenza vaccination rates averaged 45%–50% before 2008<sup>1-4</sup> and increased by only a moderate amount, to 65%, after the H1N1 influenza epidemic,<sup>5</sup> despite evidence for patient benefit.<sup>6,7</sup> Over 200,000 US patients are hospitalized annually for influenza, with an attributable 36,000 deaths.<sup>1,8,9</sup>

Low influenza vaccination rates are not confined to the United States. One survey of European countries suggested that vaccination rates were below 30% in many countries, including rates of 13% in the United Kingdom.<sup>10</sup> Despite

effective annual vaccines that protect upward of 86% of healthy adults below 65 years of age,<sup>11</sup> efforts to increase HCP vaccination rates for personal protection and patient safety have fallen short.

Currently, in the United States, most hospitals require HCP to demonstrate immunity to varicella zoster virus, measles, mumps, rubella, and hepatitis B prior to employment. It is noteworthy that influenza vaccination is not among these requirements, despite the fact that influenza morbidity and mortality exceed those of all these diseases combined.<sup>12-14</sup> For example, hepatitis B contributes to 2,000–4,000 deaths annually in the United States,<sup>15</sup> most of which are attributable to imported cases of hepatitis B. In contrast, 36,000 deaths occur annually due to influenza, nearly all of which are the

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TABLE 1. Influenza Campaign Initiatives of University of California, Irvine, Healthcare, 2006–2011

Campaign initiatives	Description	Year/season employed
Flu mobile	Mobile van provided vaccination during scheduled events for affiliated off-site clinical areas.	2006–present
Declination tool	Electronic or paper-written declination required of staff who did not want to be vaccinated.	2007–present
Decentralized distribution	Unit and clinic registered nurse managers were able to check out vaccinations from Occupational Health to distribute to their staff.	2007–present <sup>a</sup>
Mobile carts	Mobile carts were used to provide vaccine to clinics, units, and grand rounds events.	2007–present
Mandatory influenza vaccination policy	Requirement for all healthcare personnel to either be vaccinated or wear a mask on medical center grounds during the entire flu season.	2009–present
Real-time noncompliance tracking	Institution of a real-time noncompliance feedback system accessible online by staff, unit managers, division chiefs, and department chairs. Both individual staff compliance and grouped summary participation were available for comparison. Noncompliant lists were also sent to nurse managers, division chiefs, and department chairs weekly.	2009–present
Good-standing budget allocations	Dean relays to School of Medicine department chairs the line-item list of nonparticipating members and a reminder that vaccination participation for staff is a part of good-standing requirements. Failure to meet good-standing milestones could result in withholding of a portion of departmental budgets.	2010–2011

<sup>a</sup> For the 2008–2009 season, decentralized vaccine distribution was reduced because of a reevaluation of vaccine-tracking processes.

result of locally transmitted infection. The US Department of Health and Human Services has set a goal of 60% influenza vaccination among HCP by 2010 and 90% by 2020.<sup>16,17</sup>

Discouragingly low HCP influenza vaccination rates have led to a variety of strategies to increase vaccination levels. Hospital efforts have focused on increasing vaccination convenience for HCP. In a French study, the use of mobile vaccination carts in addition to education and promotional campaigns showed an increase of 25% in HCP vaccination the year after implementation.<sup>18</sup> Additionally, tools such as peer-to-peer vaccination and off-hour clinics have increased accessibility for HCP.<sup>19,20</sup> The hepatitis B declination model has also been adopted for influenza declinations at medical centers across the nation after suggestions by the Healthcare Infection Control Practice Advisory Committee (HICPAC) and the Advisory Committee on Immunization Practices (ACIP).<sup>21,22</sup> In fact, at least one state (CA) has implemented mandatory influenza declinations by HCP.<sup>23</sup> Various studies suggest a range of 11%–22% increases in vaccination of HCP after instituting required written declinations concurrently with education and other influenza vaccination campaign initiatives.<sup>24–26</sup>

More recently, the H1N1 influenza pandemic has again raised the issue of mandatory influenza vaccination of HCP for the safety of patients and hospital staff. The Infectious Diseases Society of America (IDSA) further suggested the removal of declination for philosophical reasons when instituting a mandatory vaccination policy.<sup>27</sup> The ACIP, IDSA, Society for Healthcare Epidemiology of America, Association

for Professionals in Infection Control and Epidemiology, American Hospital Association, and American College of Physicians have called for 100% vaccination of employees without medical contraindications.<sup>1,2,27–29</sup> In 2005, Virginia Mason Medical Center was the first to institute a mandatory influenza vaccination program for HCP, which led to vaccination rates of greater than 97% over a 5-year period.<sup>30</sup> Similarly successful mandatory hospital policies were introduced by both BJC HealthCare and Hospital Corporation of America Healthcare.<sup>31,32</sup> Nevertheless, other hospitals may be less willing to implement a mandatory influenza policy if other strategies, such as mobile carts and peer-to-peer vaccination campaigns, have not yet been tried.

We sought to quantify the impact of serial strategies for increasing HCP influenza vaccination rates. Our goal was to assess the incremental gains achieved by a series of nonmandatory campaign strategies and contrast those gains with those achieved by a mandatory vaccination policy. We also sought to measure HCP attitudes toward vaccination to evaluate whether the common practice of providing influenza education and campaign materials for those already in line to receive the vaccine was beneficial.

## METHODS

Beginning in 2006, University of California Irvine Healthcare (UC Irvine Health), instituted a series of vaccination campaigns that culminated in a mandatory vaccination participation policy that required all HCP (and select non-HCP) to

receive or decline vaccination beginning in the 2009–2010 influenza season. We conducted a retrospective cohort study involving personnel at UC Irvine Health during 5 influenza seasons from the fall of 2006 through the spring of 2011 to evaluate effect of specific influenza vaccination campaigns on influenza vaccination and declination rates. We also evaluated data from an anonymous convenience survey of HCP taken during the 2007–2008 influenza season. This study was exempt from human subjects oversight by the institutional review board of the UC Regents.

Influenza vaccines were available to all HCP and select non-HCP at UC Irvine Health, a tertiary care, multispecialty academic medical center in Orange County, California. This policy applied to approximately 6,500 clinical and nonclinical workers, including residents, fellows, students, volunteers, and contract workers employed at the UC Irvine Medical Center as well as faculty physicians and staff employed by the UC Irvine School of Medicine who were physically located at the medical campus or affiliated clinical areas. Vendors were also required to comply with this policy but were not included in this analysis.

### Influenza Vaccines

Influenza vaccines were provided free of charge and were thimerosal-free beginning in the 2006–2007 influenza season. HCP could provide written proof of vaccination through other providers, including receipt of intranasal preparations, which were not offered through the campaign.

### Influenza Strategies

A series of cumulative strategies to improve influenza vaccination were conducted annually. They included strategies such as the use of mobile vans to bring vaccines to off-site clinical areas, the use of mobile carts to provide vaccines at routinely scheduled physician and medical staff meetings and directly to clinical units, decentralized vaccine distribution to coworkers by designated nurses in clinical areas, mandatory declination, and eventually a mandatory vaccination policy (Table 1). All strategies were continued each season from the time of implementation. However, during the 2008–2009 season, decentralized vaccine distribution was temporarily reduced as a result of reevaluation of vaccine-tracking processes to comply with stricter state-mandated documentation.

The mandatory vaccination policy was implemented beginning in the 2009–2010 influenza season, coincident with the H1N1 influenza pandemic. The policy required either (1) vaccination with all vaccines recommended by the Centers for Disease Control and Prevention or (2) signing a paper or online declination plus masking while in medical areas or on the grounds of the medical campus for the entirety of the influenza season. Vaccination receipt was signified by a plastic colored tag on identification badges, and supervisors were instructed to ensure masking for employees without a tagged badge and to report noncompliance to the human resources

department. During the 2009–2010 influenza season, receipt of both the H1N1 and seasonal influenza vaccines was required to receive a colored tag. HCP who received only one vaccine were deemed noncompliant that year. No consequences of termination were communicated to nonparticipating personnel until the 2011–2012 season (see “Discussion”).

### Survey of Attitudes toward Influenza Vaccination

We evaluated a convenience survey conducted by the UC Irvine Medical Center Epidemiology and Infection Prevention Program during the 2007–2008 influenza season. A team of infection preventionists conducted verbal interviews of a convenience sample of 300 HCP waiting in line to receive the free influenza vaccine. The intent of the survey was to assess the utility of placing influenza vaccine campaign materials at influenza vaccine booths by assessing whether those already in line were committed to receiving the vaccine each year. The anonymous survey included information on sex, age, general clinical and nonclinical job categories, reasons for influenza vaccination, vaccine receipt during the prior year, and likelihood of vaccine receipt during the next year and questions on how long the respondent was willing to wait and how much the respondent was willing to pay to receive the influenza vaccine.

### Declinations

We evaluated declination responses from HCP over 5 consecutive influenza seasons beginning in 2006. The reasons for declination were categorized as permissible (severe allergic response, history of Guillain-Barré virus infection, and religious beliefs) or preferential (fear of adverse effects, fear of needles, fear of contracting influenza as a result of vaccination, personal belief that one was at minimal risk for acquiring influenza, philosophical reasons, and other).

### Analysis

For each influenza season, we assessed the proportion of HCP who were vaccinated, formally declined, or were neither vaccinated nor formally declined (nonparticipants). Participants included both vaccinated HCP and those who completed a declination form. All assessments were finalized as of March 31 of each influenza season. Comparisons of seasonal proportions of vaccinated HCP and nonvaccinated HCP were calculated using 2-way contingency  $\chi^2$  tests. Comparisons of the proportions of vaccinated HCP were also made between those seasons with new campaigns and the prior seasons.

Declination data for each influenza season were described according to the proportion of HCP who declined the seasonal influenza vaccine for permissible and preferential reasons. Declination data for the H1N1 vaccine were assessed separately.

For the 2007–2008 HCP survey, we recorded the proportion of HCP who provided specific answer choices to the

survey questions. For questions that addressed willingness to wait or pay for an influenza vaccination, we reported cumulative percentages indicating what fraction of HCP would be willing to wait or pay at least a certain amount.

## RESULTS

HCP vaccination, declination, and nonparticipation rates in all 5 influenza seasons are summarized in Figure 1. The annual number of clinical and nonclinical HCP ranged from 6,414 to 6,734 over the 5 seasons. In the 2006–2007 season, only 44.0% (2,863 of 6,510) of HCP were vaccinated. After institution of decentralized vaccine distribution, improved vaccine access via mobile carts, and mandatory declination, HCP vaccination rates increased significantly, to 62.9% (4,037 of 6,414 HCP;  $P < .001$ ) during the 2007–2008 influenza season. A minimal decrease in the vaccination rate to 58.3% (3,929 of 6,734 HCP) occurred during the 2008–2009 season after a decreased availability for peer-to-peer vaccination. Following the institution of a mandatory influenza vaccination policy and real-time noncompliance feedback during the 2009–2010 season, HCP vaccination rates increased to 86.7% (5,696 of 6,568 HCP;  $P < .001$ ). Of note, 52 HCP (0.8%) had received only 1 of the 2 influenza vaccines available that year (H1N1 and seasonal) and were categorized as nonparticipants. The 2010–2011 mandatory vaccination policy was strengthened by involvement of the dean of the School of

Medicine, who provided line-item lists of nonparticipants to department chairs with a reminder of the importance of good standing. Similar to the policy adopted by many academic institutions, the failure to meet thresholds of faculty in good standing with hospital policy could result in withholding of a portion of budget allocations to that department. This led to an increase in HCP vaccinations during the 2010–2011 season to 91.9% (6,047 of 6,582 HCP;  $P < .001$ ), which was primarily attributable to increased vaccinations of the subset of HCP in the School of Medicine (primarily physicians and other faculty members), which increased from 77.5% (1,917 of 2,472) during the 2009–2010 season to 93.7% (2,230 of 2,379) during the 2010–2011 season ( $P < .001$ ). Only 4 staff members were seen in Occupational Health as a result of mask complaints. In all cases, a suitable alternative mask was identified. If a staff member disagreed with the determination of Occupational Health regarding a possible allergic reaction to the mask, the staff member could seek a second opinion by having an external physician or allergist complete a physician attestation form.

Responses to the 2007–2008 survey of HCP, conducted among HCP who were in line awaiting vaccine distribution, are summarized in Table 2. Less than half of HCP (43.2%; 105 of 243) were willing to wait up to 20 minutes to receive a free influenza vaccine. One-quarter of HCP (27.2%; 66 of 243) were unwilling to wait 10 minutes. Had vaccination not

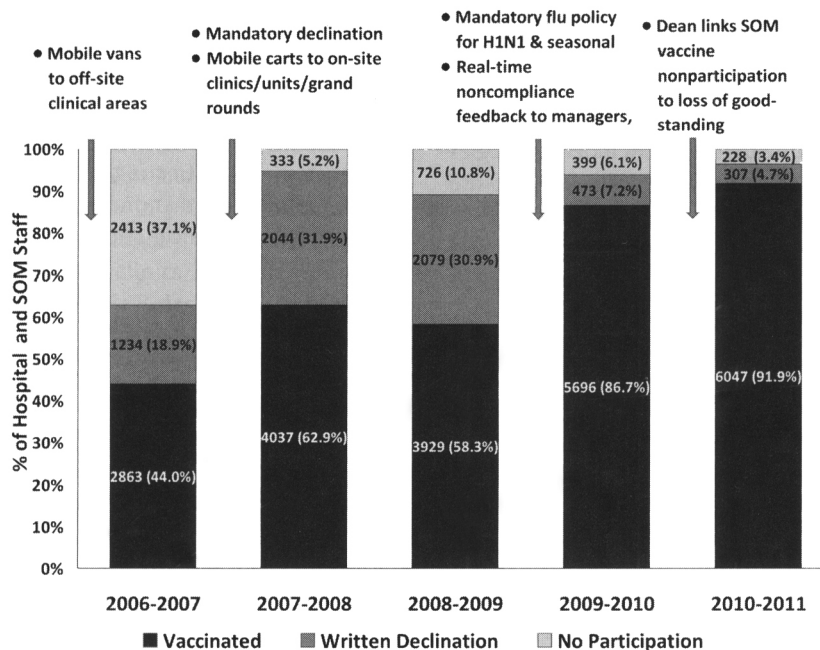


FIGURE 1. Effects of cumulative influenza vaccine campaigns on the proportion of healthcare personnel (HCP) who were vaccinated, provided written declination, or were nonparticipants in 5 consecutive influenza seasons. Campaign strategies are listed by the time of initiation and are continued through all subsequent seasons (with the exception of a temporary reduction in decentralized vaccine distribution in the 2008–2009 season). The category for nonparticipation included HCP who neither were vaccinated nor provided written declination by March 31 of the respective influenza season. During the period of mandatory vaccination, written declination included the requirement of HCP masking for the influenza season. See Table 1 for a description of campaigns.



TABLE 2. Survey Responses of Healthcare Personnel in Line to Receive Vaccine

Variable	No. (%) of respondents	
	Nonclinicians	Clinicians
Willingness to wait (cumulative)		
>30 minutes	13 (14.2)	12 (7.9)
21–30 minutes	21 (23.1)	31 (20.4)
11–20 minutes	41 (45.1)	64 (42.1)
5–10 minutes	68 (74.7)	109 (71.7)
<5 minutes	91 (100)	152 (100)
Willingness to pay (cumulative)		
\$50	4 (4.7)	3 (2.1)
\$40	5 (5.9)	4 (2.9)
\$30	7 (8.2)	16 (11.4)
\$20	33 (38.8)	59 (42.1)
\$10	59 (69.4)	97 (69.3)
\$5	73 (85.9)	128 (91.4)
Will not pay (noncumulative)		
Overall	12 (14.1)	12 (8.6)
Overall	85 (100)	140 (100)
Top reasons for vaccination (up to 3 selections)		
Protects self	85 (32.9)	152 (33.9)
Protects others	74 (28.7)	147 (32.8)
Convenience	38 (14.7)	76 (17.0)
Encouraged by boss	31 (12.0)	35 (7.8)
Encouraged by friends	20 (7.8)	24 (5.4)
Other	10 (3.9)	14 (3.1)
Overall	258 (100)	448 (100)
Flu vaccination in previous year?		
Yes	83 (83.0)	155 (88.1)
No	17 (17.0)	21 (11.9)
Did not want to	7 (7.0)	6 (3.4)
Was not offered	3 (3.0)	7 (4.0)
Did not want to get sick	1 (1.0)	2 (1.1)
Do not like needles	2 (2.0)	0 (0.0)
I never get sick	0 (0.0)	1 (0.6)
Do not believe in vaccine	0 (0.0)	1 (0.6)
Other	4 (4.0)	4 (2.3)
Overall	100 (100)	176 (100)
Will you get the vaccine next year?		
Definitely	64 (71.1)	106 (70.7)
Probably	20 (22.2)	37 (24.7)
Possibly	3 (3.3)	7 (4.7)
Unlikely	3 (3.3)	0 (0)
Overall	90 (100)	150 (100)
Feeling if vaccine ran out before you received it?		
Disappointed	45 (51.7)	78 (52.3)
Worried	15 (17.2)	30 (20.1)
Indifferent	21 (24.1)	34 (22.8)
Relieved	3 (3.4)	3 (2.0)
Other	3 (3.4)	4 (2.7)
Overall	87 (100)	149 (100)

NOTE. Total and cumulative raw values do not sum to 300 for all questions because of incomplete surveys. The most common reason for missed values related to staff being unable to finish the survey because of short wait times.

been provided for free, only 40.9% of HCP (92 of 225) would have been willing to pay \$20. Nonetheless, 14.1% of non-clinicians (12 of 85) and 8.6% of clinicians (12 of 140) indicated that they would be unwilling to pay any amount of money for influenza vaccination. The major reasons for vaccination among both nonclinical and clinical staff were to protect oneself and others, which included both patients and family members.

Among HCP respondents (who were in line to receive the vaccine), 13.8% (38 of 276) responded that they had not been vaccinated during the previous year, and only 70.8% of HCP (170 of 240) indicated that they would definitely get vaccinated during the next year. In addition, 23.3% (55 of 236) stated that they would be indifferent if they were unable to be vaccinated in the current season, and an additional 2.5% (6 of 236) stated that they would be relieved if the vaccine ran out before they received it.

Declination responses of HCP for seasonal influenza vaccines are summarized in Table 3. Throughout all seasons, declinations due to permissible reasons remained below 1% for all HCP. Declinations due to preferential reasons increased from 18.5% (102 of 6,510) to 30.9% (2,044 of 6,414) in response to mandatory declination ( $P < .001$ ) but then stably decreased to 4.2% (279 of 6,582;  $P < .001$ ) after mandatory vaccination. HCP reasons for preferential declination over all 5 seasons were 4.5% (1,476 of 32,808) for fear of adverse effects, 2.2% (713 of 32,808) for personal belief of minimal risk for influenza, 1.4% (467 of 32,808) for fear of needles, 1.3% (426 of 32,808) for fear of getting influenza from vaccination, 1.2% (397 of 32,808) for philosophical reasons, and 7.0% (2,318 of 32,808) for all other reasons. HCP declination of the H1N1 vaccine during the 2009–2010 influenza season was similar to the declination rate for the seasonal influenza vaccine during the same season.

## DISCUSSION

Ultimately, all influenza vaccination policies and campaigns are meant to ensure the safety of HCP and their patients. However, despite evidence that vaccination of HCP against seasonal and pandemic influenza protects patients,<sup>6,7</sup> vaccination for HCP in the United States remains at unacceptable levels.<sup>1–5</sup> A small number of early-adopter hospitals have accomplished effective institution of mandatory vaccination policies that have increased HCP vaccination rates to levels above 95%, with resounding success and few or no adverse effects for HCP.<sup>30–32</sup> However, nonmandatory campaigns involving education, incentives, e-mail and pager reminders, after-hours vaccination, mobile carts, mandatory declinations, and peer-to-peer vaccination have also been shown to be successful at increasing influenza vaccination among HCP.<sup>18–22,24,26</sup> Understanding the relative contributions of non-mandatory strategies versus the gains of mandatory campaigns can help inform whether mandatory campaigns are

TABLE 3. Influenza Vaccine Declination Responses of Healthcare Personnel (HCP) during the 2006–2011 Influenza Seasons

Declination responses	2006–2007	2007–2008	2008–2009	2009–2010*	2010–2011
Clinical HCP	4,203	4,124	4,377	4,301	4,381
Permissible reasons <sup>b</sup>	19 (0.5)	35 (0.8)	26 (0.6)	12 (0.3)	18 (0.4)
Preferential reasons <sup>c</sup>	698 (16.6)	1,218 (29.5)	1,272 (29.1)	158 (3.7)	154 (3.5)
Overall	717 (17.1)	1,253 (30.4)	1,298 (29.7)	170 (4.0)	172 (3.9)
Nonclinical HCP	2,307	2,290	2,357	2,267	2,201
Permissible reasons	13 (0.6)	24 (1.0)	20 (0.8)	9 (0.4)	10 (0.5)
Preferential reasons	504 (21.8)	767 (33.5)	761 (32.3)	140 (6.2)	125 (5.7)
Overall	517 (22.4)	791 (34.5)	781 (33.1)	149 (6.6)	135 (6.1)
Total HCP	6,510	6,414	6,734	6,568	6,582
Permissible reasons	32 (0.5)	59 (0.9)	46 (0.7)	21 (0.3)	28 (0.4)
Preferential reasons	1,202 (18.5)	1,985 (30.9)	2,033 (30.2)	298 (4.5)	279 (4.2)
Total HCP declinations	1,234 (19.0)	2,044 (31.9)	2,079 (30.9)	319 (4.9)	307 (4.7)

NOTE. Data are no. (%) of responses, unless otherwise indicated.

\* Based upon seasonal (not H1N1) vaccine declinations.

<sup>b</sup> Permissible reasons included allergies, history of Guillain-Barré virus infection, and religious beliefs.

<sup>c</sup> Preferential reasons primarily included fear of needles, fear of adverse effects, and philosophical reasons.

necessary for achieving high influenza vaccination among HCP.

We showed that campaign strategies such as decentralized vaccine distribution, mobile carts, and mandatory declination, which complimented already-existing vaccination fairs and educational campaigns instituted before 2006, were successful in significantly increasing HCP vaccination from approximately 45% to 60%. This is consistent with other studies that have reported moderate (~20%) increases in HCP vaccination based upon similar strategies.<sup>18,24–26</sup> Nevertheless, the cumulative use of these campaigns, even over a 2-year period, was unable to increase HCP vaccination rates beyond 60%. Only the addition of a mandatory vaccination policy enabled instantaneous gains in vaccination to levels above 90%. We expect additional gains during the 2011–2012 season with the institution of unpaid furlough for those HCP with nonparticipation in vaccination as of December 1, 2011.

Mandatory influenza vaccination policies for HCP have the potential to increase vaccination rates nationally and worldwide. However, merely approving such a policy without enforcing it is unlikely to be successful. In this instance, the involvement of hospital leadership and human resources personnel was necessary to achieve near-complete vaccination. The institution of a real-time noncompliance tracking tool was pivotal in ensuring participation, because staff members were held directly accountable to their supervisors rather than to Occupational Health. Furthermore, e-mail reminders of the mandatory nature of vaccination from the chief medical officer and chief executive officers instilled the gravity of the mandatory vaccination policy in HCP.

Similar to other academic institutions, we encountered issues of accountability for physicians, because many are employed by and accountable to the School of Medicine rather than the hospital system. This was reflected in the first season of mandatory influenza policy, when vaccination of medical

center HCP already surpassed 90%, whereas vaccination rates among School of Medicine HCP were 78%. However, in the following season of mandatory vaccination policy, a significant increase to 94% for School of Medicine HCP was attained by the active involvement of the dean to reinforce the importance of good standing, which often carries financial repercussions for School of Medicine departments whose members fail to meet thresholds of compliance with institutional policy. Because all departments met good standing requirements, we can only assume that this had a substantial impact. The issue of separation of physicians from hospital staff is not confined to academic institutions, because community hospitals often contract physician groups for hospital service. This strategy has not, to our knowledge, been previously reported and may be helpful in increasing physician vaccination rates when incentives are tied to compliance with annual requirements.

As mandatory influenza vaccination is increasingly promulgated,<sup>30–32</sup> issues have been raised related to the ethical, legal, and economic impact of such a policy.<sup>33–37</sup> In this context, it is necessary to overcome many HCP misconceptions about the influenza vaccine. For example, in this study, concern for vaccine safety remained a major reason among those who declined vaccination in favor of masking for the duration of the influenza season. This occurred despite long-standing data on safety, including a systemic adverse effect profile similar to that for placebo.<sup>38</sup>

We found that the majority of vaccine declinations by HCP were attributable to preferential reasons. The proportion of HCP who declined for permissible reasons remained small (<1%) throughout all seasons, including under the mandatory vaccination policy. In contrast, the proportion of declinations for preferential reasons markedly increased in response to the mandatory declination requirement and dramatically decreased in response to mandatory vaccination.

One explanation for this may be that mandatory declination differentially captures HCP who feel strongly about declining the vaccine but does not capture those who, although not opposed to the vaccine, have not made vaccination a priority. In contrast, the masking requirement associated with lack of influenza vaccination under the mandatory policy may provide sufficient disincentive to encourage the large number of stragglers to prioritize vaccination.

This highlights the importance of understanding the needs and attitudes of HCP to overcome both reluctance and inertia toward annual influenza vaccination. This is most clearly indicated by survey data that indicate that there are still gains to be made by targeting HCP who have been vaccinated in previous years.

We found that convenience was an essential factor in HCP vaccination, even for those who had already decided to receive the vaccine. The unwillingness of one-quarter of HCP to wait for more than 10 minutes indicated that high vaccination rates require highly convenient access and minimal effort for HCP. However, we showed that even with maximum convenience, including after-hours events, centralized and decentralized vaccine distribution, and mobile cart and mobile van vaccinations, only 60% of HCP were vaccinated.

We compared the effectiveness of educational campaigns, vaccination event reminders, after-hours vaccination, mobile carts, mobile vans, mandatory declinations, and decentralized peer-to-peer vaccination strategies with the effectiveness of a mandatory HCP vaccination policy. Although the cumulative use of these campaigns significantly improved vaccination levels beyond the national norm, a mandatory vaccination policy was needed to reach vaccination levels in excess of 90%. Although the successful implementation of such policy requires substantial resources, administrative support, and cooperation of HCP, it rapidly achieved the intended goal of providing a safe medical campus to patients and HCP for a disease that still claims over 30,000 lives annually.

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#### REFERENCES

1. Fiore AE, Uyeki TM, Broder K, et al. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010. *MMWR Recomm Rep* 2010;59(RR-8):1–62.
2. Walker FJ, Singleton JA, Lu P, Wooten KG, Strikas RA. Influenza vaccination of healthcare workers in the United States, 1989–2002. *Infect Control Hosp Epidemiol* 2006;27(3):257–265.
3. Caban-Martinez AJ, Lee DJ, Davila EP, et al. Sustained low influenza vaccination rates in US healthcare workers. *Prev Med* 2010;50(4):210–212.
4. Interim results: influenza A (H1N1) 2009 monovalent and seasonal influenza vaccination coverage among health-care personnel—United States, August 2009–January 2010. *MMWR Morb Mortal Wkly Rep* 2010;59(12):357–362.
5. Influenza vaccination coverage among health-care personnel—United States, 2010–11 influenza season. *MMWR Morb Mortal Wkly Rep* 2011;60:1073–1077.
6. Hayward AC, Harling R, Wetten S, et al. Effectiveness of an influenza vaccine programme for care home staff to prevent death, morbidity, and health service use among residents: cluster randomised controlled trial. *BMJ* 2006;333(7581):1241.
7. Lemaitre M, Meret T, Rothan-Tondeur M, et al. Effect of influenza vaccination of nursing home staff on mortality of residents: a cluster-randomized trial. *J Am Geriatr Soc* 2009;57(9):1580–1586.
8. Thompson WW, Shay DK, Weintraub E, et al. Influenza-associated hospitalizations in the United States. *JAMA* 2004;292(11):1333–1340.
9. Thompson WW, Shay DK, Weintraub E, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. *JAMA* 2003;289(2):179–186.
10. Mereckiene J, Cotter S, D’Ancona F, et al. Differences in national influenza vaccination policies across the European Union, Norway and Iceland 2008–2009. *Euro Surveill* 2010;15(44):1–4.
11. Bridges CB, Thompson WW, Meltzer MI, et al. Effectiveness and cost-benefit of influenza vaccination of healthy working adults: a randomized controlled trial. *JAMA* 2000;284(13):1655–1663.
12. Orenstein WA, Papania MJ, Wharton ME. Measles elimination in the United States. *J Infect Dis* 2004;189(suppl 1):S1–S3.
13. Nguyen HQ, Jumaan AO, Seward JF. Decline in mortality due to varicella after implementation of varicella vaccination in the United States. *N Engl J Med* 2005;352(5):450–458.
14. Reef SE, Frey TK, Theall K, et al. The changing epidemiology of rubella in the 1990s: on the verge of elimination and new challenges for control and prevention. *JAMA* 2002;287(4):464–472.
15. Vogt T, Wise M, Shih H, Williams I. Hepatitis B mortality in the United States. In: *45th Annual Meeting of Infectious Diseases Society of America*; 2007; San Diego, CA.
16. HealthyPeople.gov. <http://www.healthypeople.gov>. Accessed March 1, 2010.
17. Shefer A. Healthy people 2020 update. In: *National Influenza Summit*; 2011; San Diego, CA.
18. Sartor C, Tissot-Dupont H, Zandotti C, Martin F, Roques P, Drancourt M. Use of a mobile cart influenza program for vaccination of hospital employees. *Infect Control Hosp Epidemiol* 2004;25(11):918–922.

19. Trape-Cardoso M, Divinere M, Barnosky S. Improving compliance with influenza vaccination for hospital healthcare workers from high-risk areas: a 6-year analysis. *Am J Infect Control* 2005;33(5):e89.
20. Interventions to increase influenza vaccination of health-care workers—California and Minnesota. *MMWR Morb Mortal Wkly Rep* 2005;54(8):196–199.
21. Talbot TR. Do declination statements increase health care worker influenza vaccination rates? *Clin Infect Dis* 2009;49(5):773–779.
22. Pearson ML, Bridges CB, Harper SA. Influenza vaccination of health-care personnel: recommendations of the Healthcare Infection Control Practices Advisory Committee (HICPAC) and the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep* 2006;55(RR-2):1–16.
23. California hospital influenza law. In: *California Health and Safety Code, Division 2*. Sacramento, CA: Legislative Counsel, 2006.
24. Polgreen PM, Septimus EJ, Parry MF, et al. Relationship of influenza vaccination declination statements and influenza vaccination rates for healthcare workers in 22 US hospitals. *Infect Control Hosp Epidemiol* 2008;29(7):675–677.
25. Bertin M, Scarpelli M, Proctor AW, et al. Novel use of the intranet to document health care personnel participation in a mandatory influenza vaccination reporting program. *Am J Infect Control* 2007;35(1):33–37.
26. Ribner BS, Hall C, Steinberg JP, et al. Use of a mandatory declination form in a program for influenza vaccination of healthcare workers. *Infect Control Hosp Epidemiol* 2008;29(4):302–308.
27. *IDSA Policy on Mandatory Immunization of Health Care Workers Against Seasonal and Pandemic Influenza*. Arlington, VA: Infectious Diseases Society of America, 2011.
28. Talbot TR, Babcock H, Caplan AL, et al. Revised SHEA position paper: influenza vaccination of healthcare personnel. *Infect Control Hosp Epidemiol* 2010;31(10):987–995.
29. Greene LR, Cox T, Dolan S, et al. *APIC Position Paper: Influenza Vaccination Should Be a Condition of Employment for Healthcare Personnel, Unless Medically Contraindicated*. Washington, DC: APIC, 2011.
30. Rakita RM, Hagar BA, Crome P, Lammert JK. Mandatory influenza vaccination of healthcare workers: a 5-year study. *Infect Control Hosp Epidemiol* 2010;31(9):881–888.
31. Babcock HM, Gemeinhart N, Jones M, Dunagan WC, Woeltje KF. Mandatory influenza vaccination of health care workers: translating policy to practice. *Clin Infect Dis* 2010;50(4):459–464.
32. Septimus EJ, Perlin JB, Cormier SB, Moody JA, Hickok JD. A multifaceted mandatory patient safety program and seasonal influenza vaccination of health care workers in community hospitals. *JAMA* 2011;305(10):999–1000.
33. van Delden JJ, Ashcroft R, Dawson A, Marckmann G, Upshur R, Verweij MF. The ethics of mandatory vaccination against influenza for health care workers. *Vaccine* 2008;26(44):5562–5566.
34. Ottenberg AL, Wu JT, Poland GA, Jacobson RM, Koenig BA, Tilburt JC. Vaccinating health care workers against influenza: the ethical and legal rationale for a mandate. *Am J Public Health* 2011;101(2):212–216.
35. Talbot TR. Improving rates of influenza vaccination among healthcare workers: educate; motivate; mandate? *Infect Control Hosp Epidemiol* 2008;29(2):107–110.
36. Helms CM, Polgreen PM. Should influenza immunisation be mandatory for healthcare workers? yes. *BMJ* 2008;337:a2142.
37. Isaacs D, Leask J. Should influenza immunisation be mandatory for healthcare workers? no. *BMJ* 2008;337:a2140.
38. Nichol KL, Margolis KL, Lind A, et al. Side effects associated with influenza vaccination in healthy working adults: a randomized, placebo-controlled trial. *Arch Intern Med* 1996;156(14):1546–1550.