ORIGINAL ARTICLE

Mandatory Influenza Vaccination of Healthcare Workers: A 5-Year Study

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(See the commentary by Talbot and Schaffner, on pages 889–892.)

BACKGROUND. The rate of influenza vaccination among healthcare workers (HCWs) is low, despite a good rationale and strong recommendations for vaccination from many health organizations.

OBJECTIVE. To increase influenza vaccination rates by instituting the first mandatory influenza vaccination program for HCWs.

DESIGN AND SETTING. A 5-year study (from 2005 to 2010) at Virginia Mason Medical Center, a tertiary care, multispecialty medical center in Seattle, Washington, with approximately 5,000 employees.

METHODS. All HCWs of the medical center were required to receive influenza vaccination. HCWs who were granted an accommodation for medical or religious reasons were required to wear a mask at work during influenza season. The main outcome measure was rate of influenza vaccination among HCWs.

RESULTS. In the first year of the program, there were a total of 4,703 HCWs, of whom 4,588 (97.6%) were vaccinated, and influenza vaccination rates of more than 98% were sustained over the subsequent 4 years of our study. Less than 0.7% of HCWs were granted an accommodation for medical or religious reasons and were required to wear a mask at work during influenza season, and less than 0.2% of HCWs refused vaccination and left Virginia Mason Medical Center.

CONCLUSION. A mandatory influenza vaccination program for HCWs is feasible, results in extremely high vaccination rates, and can be sustained over the course of several years.

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According to reports from the Centers for Disease Control and Prevention, each year in the United States, more than 200,000 people are hospitalized for influenza illness, and each year in the United States, more than 36,000 people die of influenza,[1,2] a mortality rate similar to that of people with breast cancer.[3,4] Fortunately, a safe vaccine exists that is 70%–90% effective in preventing influenza illness in healthy adults less than 65 years of age.[5-8] Unfortunately, the vaccine is not as effective for people 65 years of age or older, for those who are immunocompromised, or for those with certain chronic medical conditions.[8,9] Thus, although these types of people are the most likely to be hospitalized, they remain the most vulnerable to influenza illness, despite having received the vaccine.[10,11]

For many years, the Centers for Disease Control and Prevention, along with many other health organizations, has recommended influenza vaccination of healthcare workers (HCWs).[8,12-14] Despite this recommendation, most HCWs have refrained from being vaccinated, with vaccination rates nationally at approximately 44%.[8] Multiple efforts to increase these rates at individual medical centers, by use of a variety of techniques, have been only modestly successful.[15] Not surprisingly, HCWs have been involved in the spread of influenza in multiple healthcare settings.[16-19] Studies have demonstrated that vaccination of HCWs not only prevents illness among the HCWs themselves but also prevents morbidity and mortality from influenza among their patients.[20-24]

One option for increasing vaccination rates among HCWs is to make vaccination mandatory, and a few health organizations have recently adopted a mandatory influenza vaccination policy for their HCWs.[25,26] BJC HealthCare in St Louis, Missouri, recently implemented such a policy and was able to achieve a 98.4% vaccination rate in the first year after implementation.[27] In addition, the New York State Health Department adopted a regulation in August 2009 requiring

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influenza vaccination of all HCWs with direct patient contact,[28] although it was later rescinded.

In 2004, Virginia Mason Medical Center in Seattle, Washington, was the first to make annual influenza vaccination a "fitness-for-duty" requirement of every employee of the medical center. Because of the vaccine shortage that year, the requirement did not go into effect until the 2005–2006 influenza season. Since that time, vaccination rates at the medical center have been consistently high (ie, 97.5% or more). We describe our application of this requirement, our ability to sustain high vaccination rates for several years, and the costs and obstacles associated with this effort.

METHODS

Setting

Virginia Mason Medical Center in Seattle, Washington, is a tertiary care, multispecialty medical center that includes a 336-bed hospital, adjoining outpatient clinics, 7 regional clinics, and a research center, that provides residency teaching programs, and that employs approximately 400 physicians and a total of approximately 5,000 HCWs.

Multidisciplinary Task Force

The recommendation to require influenza vaccination of HCWs was the result of a workshop that was held to increase influenza vaccination rates at the medical center. It was subsequently approved by the board of trustees. There was strong support from the chief executive officer (CEO) and the president of Virginia Mason Medical Center. A multidisciplinary task force was assembled to lead the influenza vaccination campaign during the first year of implementation. This task force consisted of representatives from the departments of employee health, infectious diseases, human resources, communications, and education and from infection control, clinic management, inpatient nursing, the legal department, the pharmacy, and the call center. A senior vice president of the medical center and a deputy chief of medicine were sponsors of the work and active participants in the task force.

Campaign

In the spring of 2005, multiple focus groups of staff and managers were created to gather data on the barriers, educational deficits, and preferences in receiving information with regard to vaccinations. The campaign was organized around the information gathered during these focus-group sessions. The campaign began that summer and included an informational Web site with links to outside sources of information (eg, from the Centers for Disease Control and Prevention); an online learning module; meetings with staff and leadership to answer questions; grand rounds speakers; trained advocates, or "champions," of influenza vaccination; and one-on-one meetings with concerned staff. These champions included the president and CEO of the medical center. The different ways in which the staff were engaged included organization-wide "fun" flu quizzes with prizes; a name-the-campaign contest; a vaccination kickoff party with food, games, and members of the local professional football team attending; and an influenza video created by staff members with personal stories. In subsequent years, during the annual fall kickoff party, approximately 20% of employees were vaccinated.

Requirement of Influenza Vaccination

All employees of the medical center are required to receive the influenza vaccine. In addition, other people working at the medical center, such as students, vendors, volunteers, contractors, and outside physicians, are required to be vaccinated. No form of declination statement is used. During the 2009–2010 season, employees were required to receive both the seasonal influenza vaccine and the influenza A (2009) H1N1 vaccine.

Vaccine Delivery

Multiple delivery methods have been used, including peer vaccinators in the clinics and in the hospital, a flu cart available at all times for use by hospital staff, and a mobile flu cart that roams the hospital and the clinics and is staffed by members of employee health. Employee health has extended hours of operation. A drive-through vaccination station was created that enables easier access for both patients and employees, and free coffee is provided, yielding the opportunity for a "double shot." Employees also may receive the influenza vaccine elsewhere; if so, they are required to bring in documentation, and they will be reimbursed the cost.

Influenza Vaccine

Multiple types of influenza vaccine are available for staff. Thimerosal-preserved injectable killed virus vaccine, thimerosal-free injectable vaccine, and live, attenuated nasal vaccine are all offered, as available and appropriate. For those employees with a fear of needles, the nasal vaccine provides a useful option.

Vaccine Allergy

Allergic reactions to influenza vaccine are extremely rare, and even people with documented egg allergy are usually able to tolerate vaccination.[29,30] HCWs with a history of egg allergy or vaccine allergy are offered skin tests[29] and vaccination in the allergy laboratory at no cost to the employee.

Accommodations

HCWs can apply for an accommodation for medical or religious reasons. A standardized form is used; supporting documentation from a medical provider or a religious leader is not required but could be submitted. Requests are reviewed by an employee health nurse, a human resources leader, and/or a physician. If an accommodation request is denied, the

HCW can request a meeting with members of the influenza vaccination group to discuss this further. HCWs who are granted an accommodation are required to wear a surgical mask while at work during the entire influenza season. Written guidelines for wearing a mask are provided, and an agreement to wear a mask is signed by the HCW and his or her manager.

RESULTS

During the 2003–2004 influenza season, 54.0% of employees at Virginia Mason Medical Center were vaccinated with influenza vaccine (Figure 1); the influenza vaccination rate decreased to 29.5% the following year because of a national vaccine shortage. Our requirement for influenza vaccination began during the 2005–2006 season, and our influenza vaccination rate increased to 97.6%. The vaccination rate increased slightly during the subsequent influenza seasons, up to 98.9% for the 2009–2010 season. The total number of employees vaccinated can be seen in Table 1. In addition to our employees, we vaccinate approximately 1,300 additional people each year, including students, contractors, volunteers, vendors, and outside physicians working at our medical center. Our vaccination process has become more efficient, such that, at the 2008 kickoff party, 1,010 employees were vaccinated during a 3-hour period.

During the first year of the requirement of influenza vaccination, 31 HCWs were granted an accommodation for medical or religious reasons. That number has remained stable during subsequent years of our study (Table 1). In the first year of the requirement (the 2005–2006 influenza season), 7 HCWs reported a history of egg allergy or a reaction to the vaccine and underwent skin testing. Results were positive for 2 of the 7 HCWs, and 1 of these 2 HCWs received the vaccine with no reaction. The other HCW with the positive skin test result elected not to receive vaccine and was granted an accommodation. In the subsequent years of our study, 1–2 HCWs per year were tested, and all have received the vaccine without significant adverse reactions.

The only unionized employees at Virginia Mason Medical Center are the inpatient nurses. When the fitness-for-duty policy was adopted, the Washington State Nurses Association (WSNA) filed a grievance on behalf of the unionized nurses, claiming that any new requirement for those nurses had to be negotiated as part of their collective bargaining agreement. An arbitrator found in their favor, and that decision was upheld on appeal. As a result, inpatient nurses who belong to the union are not required to be vaccinated. Despite the aforementioned decision, 515 (85.9%) of the 599 unionized inpatient nurses at our medical center elected to be vaccinated in 2005–2006, and that proportion increased to 595 (95.8%) of 621 unionized inpatient nurses in 2009–2010 (Table 1). The WSNA also filed an unfair labor practice charge regarding the requirement that nonvaccinated HCWs wear masks during the influenza season. An administrative law judge ruled that it was permissible to require unionized HCWs to wear a mask as part of an infection control policy. This ruling is currently pending appeal at the National Labor Relations Board.

A small number of HCWs refused to be vaccinated. Five HCWs voluntarily left, and 2 were terminated during the 2005–2006 influenza season. Since then, only 2 HCWs have left as a result of the influenza vaccination requirement.

A significant amount of human and financial resources are required for this effort, including employee time and cost of vaccine and supplies. During the first 2 years of our study, a core planning group of approximately 12 people (administrators, nurses, and physicians) met weekly for several months before and during the influenza season. Vaccinating

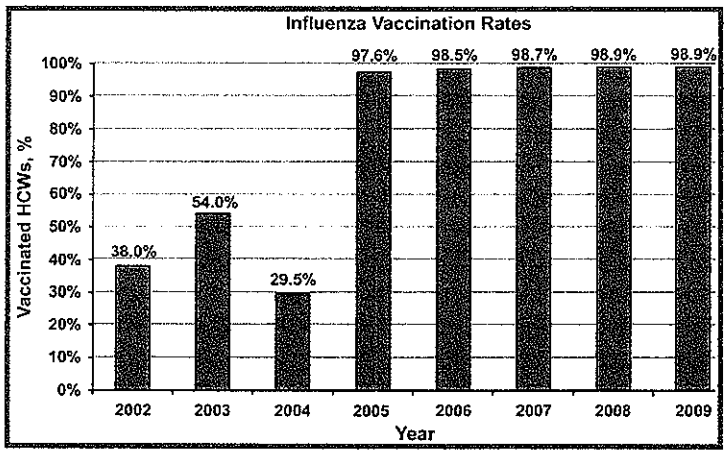

FIGURE 1. Annual influenza vaccination rates (percentage of healthcare workers [HCWs] who received vaccine) during our 5-year study of the mandatory influenza vaccination program at Virginia Mason Medical Center in Seattle, Washington. The year listed indicates the influenza season that began that fall and extended to the following spring. For example, "2002" represents the 2002–2003 influenza season, and so on.

TABLE 1. Data on Mandatory Influenza Vaccination Program for Healthcare Workers (HCWs) at Virginia Mason Medical Center in Seattle, Washington

	No. (%) of HCWs during 5 different influenza seasons				
HCW status	2005–2006 (n = 4,703)	2006–2007 (n = 4,815)	2007–2008 (n = 4,720)	2008–2009 (n = 4,863)	2009–2010 (n = 5,024)
Vaccinated	4,588 (97.6)	4,742 (98.5)	4,660 (98.7)	4,808 (98.9)	4,967 (98.9)
Medical accommodation	12 (0.3)	11 (0.2)	14 (0.3)	16 (0.3)	19 (0.4)
Religious accommodation	19 (0.4)	7 (0.1)	8 (0.2)	8 (0.2)	12 (0.2)
Nonvaccinated inpatient nurse	84 (1.8)	55 (1.1)	38 (0.8)	31 (0.6)	26 (0.5)
All nonvaccinated	115 (2.4)	73 (1.5)	60 (1.3)	55 (1.1)	57 (1.1)

NOTE. The years listed indicate the influenza seasons that began in the fall and extended to the following spring.

more than 5,000 HCWs requires more than 500 hours of nursing and medical assistant time. In addition to employee health staff, the effort has required many peer vaccinators, agency staff, and volunteers. Clerical support is needed to track vaccinated employees. Storage space is required for vaccine, including refrigerators and, in the past, freezers. The acquisition cost of the vaccine itself is approximately $70,000 for the approximately 6,000 doses needed.

A dedicated effort to evaluate outcomes was unfortunately beyond the scope of this work. We did examine overall employee sick leave time during the months of January and February (the typical peak influenza season in our region) over the course of several years. The mean duration ($\pm$ standard error) of sick leave decreased from 7.1 $\pm$ 0.2 hours per HCW during the 2001–2005 influenza season to 6.6 $\pm$ 0.6 hours per HCW during the 2006–2009 influenza season, which was not statistically significant (P = .43, determined by use of the 2-tailed t test). However, there was considerable variability from year to year. A large number of factors potentially affect sick leave, and we cannot say for certain whether there was a change due to influenza vaccination alone.

DISCUSSION

Patients experience unintended and preventable harm every day while receiving medical care in the United States.[31] Nosocomial transmission of influenza, with resultant illness and even mortality, is just one of the potential harms.[10,11,16-19] Like hand washing, influenza vaccination is something patients assume that HCWs do routinely. In fact, only approximately 44% of HCWs get vaccinated annually.[8]

Multiple reasons exist for HCW resistance to influenza vaccination, including cost, inconvenience, and fear of needles.[13,32] Some of the more common bits of misinformation associated with influenza vaccine include (1) a belief that one can get influenza from the vaccine, (2) an assumption that "flu" is a mild illness, and (3) a fear of adverse effects associated with the vaccine.[13] Educational efforts—which explain that the injectable vaccine contains a killed virus and therefore cannot cause influenza, that illness due to influenza may be severe and even fatal, and that adverse effects due to the vaccine are typically mild and (other than a sore arm) are no different than those seen with placebo[33,34]—are useful but still have not led to a dramatic increase in vaccination rates.[35]

Advocates of influenza vaccination of HCWs typically have used a multipronged approach: educational efforts, easy access to vaccine using mobile carts,[36] and promotions such as prizes for participating. Before 2005, this was the multipronged approach used at Virginia Mason Medical Center, and despite the extensive effort expended, our vaccination rate was only approximately 50%. Although this approach has been used for decades, most healthcare institutions have not had much greater success than we did[15]; occasionally, they have reached a 70%–80% vaccination rate.[37-39]

Another approach that has been promoted more recently involves a "requirement" for influenza vaccination, while allowing HCWs to refuse to receive it by signing a declination statement. This approach is patterned after an approach that was used to increase hepatitis B vaccination rate among HCWs and is intended to ensure that HCWs receive appropriate information regarding the benefits and rationale for vaccination.[40] Unfortunately, the addition of declination statements has only slightly increased influenza vaccination rates among HCWs[40,41] while adding additional administrative burden, although one medical center recently reported an 88% vaccination rate using this approach.[42]

To our knowledge, Virginia Mason Medical Center was the first medical center to institute a mandatory influenza vaccination policy for all employees, and we have demonstrated our ability to sustain this practice by maintaining vaccination rates of more than 98% over several years. Note that, if one includes HCWs who wore masks because of an accommodation or because they were a member of WSNA, compliance with this policy did approach 100%. One of the key requirements for the success of such a program is to have strong support from the leadership of the healthcare institution. Many objections to implementation of the program were raised, and without a strong endorsement from the CEO, president, and governing board, it is unlikely that the program would have been successful. Extensive communication is also required, and the use of multiple staff focus groups in plan-

ning the influenza vaccination campaign the first year helped to ensure that needed information was available to staff in a variety of different ways.

Another key requirement for such a program is an infrastructure that enables delivery of a large quantity of vaccine and the ability to track employees to ensure compliance. Considering the other requirements for an employee health program at present, we believe that it is likely that most healthcare institutions would be able to adapt their current practices, with the major need being that of additional work hours for vaccinating and tracking employees.

During our planning, the question arose as to whether the requirement should be limited just to HCWs with direct patient contact. Our decision to extend it to all HCWs greatly simplified tracking, and it eliminated the often difficult question of what constitutes direct patient contact. This decision also provided a sense of fairness among HCWs.

Many objections have been raised to mandatory influenza vaccination of HCWs.[43,44] It has been said that the penalty of unemployment for noncompliance would be coercion and would have a detrimental effect on employee-employer interactions, resulting in the loss of many HCWs. However, only 7 (0.15%) of 4,703 HCWs left during the first year of the requirement, including those who were terminated and those who cited the influenza vaccination requirement as the reason for their leaving. At BJC HealthCare, a similar percentage of employees (0.03%) were terminated as a result of this requirement.[27] Over the course of the last 4 influenza seasons, only 2 additional HCWs have left Virginia Mason Medical Center as a result of this requirement. Employee satisfaction, as judged by an annual external survey, has actually improved in recent years, and many HCWs say that they are proud to belong to a healthcare organization that puts patient safety first. Since the institution of mandatory influenza vaccination of HCWs, our annual "Culture of Safety" survey has shown consistent improvement with regard to response rate and overall grade for patient safety. In 2009, there was a 81% response rate of staff, and staff ratings of very good or excellent on the overall grade for patient safety were at 80%.

At Virginia Mason Medical Center, influenza vaccination has become just one of several fitness-for-duty requirements. Many of these have been in place nationally for years and have not raised much controversy. For example, skin testing for latent tuberculosis is analogous to influenza vaccination in many ways: both are typically required annually, involve administration of a biological agent with relatively few adverse effects, and are used for the benefit of the HCWs and their patients.[45] Yet no major objections arise from tuberculosis skin testing.

Others have questioned the need to increase influenza vaccination rates among HCWs, claiming that HCWs should simply avoid patient contact when ill. Unfortunately, although HCWs say that they will stay home when sick, in reality, many HCWs routinely come to work with symptoms of influenza-like illness.[32,46,47] In addition, people may shed influenza virus during the 24 hours before the onset of clinical illness[48] or in the absence of clinical symptoms,[49] which enables HCWs to transmit the virus to their patients, even when the HCWs feel well.

A variety of ethical issues are involved in a mandatory program such as this. In sum, one attempts to balance the benefits that accrue to patient safety against the loss of the individual's right to choose.[50-52] During the planning process for our program, the ethics committee was involved, and we enlisted the help of outside ethicists as well. Overall, it was felt that the importance of protecting our patients was paramount.

However, a mandatory program needs to be flexible enough so that valid reasons for avoiding vaccine use can be accommodated. We include both medical and religious reasons as part of this process. For example, our HCWs have had their accommodation requests approved if they had a prior history of Guillain-Barré syndrome, even though the connection between that and influenza vaccine is controversial.[8,53,54]

We require nonvaccinated HCWs, whether because of an accommodation or the union dispute, to wear a mask during influenza season. However, opponents of this accommodation have argued that there was little evidence to support this practice for reducing transmission of influenza, and they have claimed that its primary effect was punitive. Masks clearly reduce cough-related effluence,[55] and studies have demonstrated that the use of surgical masks can reduce the transmission of influenza,[56-60] reinforcing the validity of this approach. Note that our use of masks in this situation is an attempt to reduce transmission from an infected HCW to a patient, not an attempt to prevent influenza transmission from an infected patient to an HCW, which has engendered much controversy recently with the 2009 H1N1 pandemic.[61,62]

The major cost associated with this effort involves the acquisition and administration of vaccine. The large amount of time necessary for planning and coordination decreased significantly after the first 2 years of our study. After that, HCWs were familiar with the requirement, and new employees are presented with the requirement at the time of hiring. Thus, influenza vaccination has become routine and is integrated into our culture of safety. Also, vaccinating HCWs is likely to be cost-effective when the benefits of reducing both HCW absenteeism and the spread of infection to their patients are taken into account.[6,46,63,64]

When considering implementation of this type of program, it is important to consider the resistance that may be encountered by unions and the resulting litigation. The costs related to this litigation may be considerable. Although all unions are clearly not the same, it is interesting to note that unions in New York[65] and Iowa[66] also filed suit to block implementation of mandatory influenza vaccination requirements at healthcare institutions in those 2 states. We would hope that such actions are not an inevitable response to these

programs. Early communication with union members may be beneficial.

There are several potential benefits to such a program. Influenza vaccination provides protection to the HCWs themselves and to their families, may reduce absenteeism and thus enable better staffing during influenza season, and improves patient safety. An emphasis on all of these aspects was an important part of our educational campaign. Another benefit of this program is that it has provided us with experience in vaccinating a large number of employees in an efficient manner. This may prove particularly advantageous when a similar need arises with a different vaccine or for the distribution of supplies in the setting of a large-scale disaster.

There are several limitations to our study. We did not systematically look for influenza in either HCWs or hospitalized patients, and thus we cannot show that increasing the vaccination rate among HCWs had any significant effect on influenza-related illness in these populations. However, prior studies have demonstrated such a benefit in reducing illness and mortality in patients after the vaccination of HCWs.[20-24] Also, the reduction in HCW absenteeism that we found, although not significant, is similar to that seen in prior trials.[6,7,46,67] Our program was implemented at a single tertiary care medical center, so it may not be completely generalizable to other settings. And unlike at BJC HealthCare,[27] we did require that all people working at the medical center, including outside physicians, be vaccinated. Nevertheless, the basic principles, the requirements for such a program, and the potential pitfalls are likely to be similar elsewhere.

In the future, it is possible that the rates of influenza vaccination among HCWs at a given healthcare institution will be publicly available. If so, consumer-based demand may also be a driver for increasing vaccination rates. After all, if you had a choice of where to receive your health care, would you rather go to a place where your caregivers had been vaccinated or to a place where they had not?

In summary, we developed and implemented a mandatory influenza vaccination program for all of our employees, and we have been able to maintain vaccination rates of 98% or more for several years. This program provides benefits to the HCWs themselves, potentially to the healthcare institution, and, most importantly, to our patients. Although this program originally required a significant investment in planning and coordination, it is now integrated into the routine workings of our institution. Other mandatory influenza vaccination programs patterned after this program are being implemented elsewhere, and we hope that this becomes the standard practice throughout the medical community.

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Potential conflicts of interest. R.M.R. reports that he owns stock (less than $10,000 in value) in Pfizer. All other authors report no conflicts of interest relevant to this article.

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R.M.R. and J.K.L. had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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COMMENTARY

On Being the First: Virginia Mason Medical Center and Mandatory Influenza Vaccination of Healthcare Workers

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(See the article by Rakita et al, on pages 881–888.)

Simply put, there has to be a "first"—an innovator, a pioneer, a trailblazer. The practice of infection control and prevention has been affected by many important firsts aimed at reducing healthcare-associated infections in patients and healthcare workers (HCWs). The introduction by Ignaz Semmelweis in 19th century Vienna of hand hygiene as an infection prevention strategy was a seminal event that serves as the foundation of all other infection control strategies.[1] The first utilization of a bundle of practices, including the use of the now well-known "central line checklist" to prevent central line–associated bloodstream infections, can be traced to efforts at Johns Hopkins Hospital and the Pittsburgh Regional Healthcare Initiative.[2,3] In this issue of the journal, Rakita et al[4] from Virginia Mason Medical Center (VMMC) in Seattle, Washington, describe another important first in the field of infection control and prevention—the first implementation of a requirement for HCWs to receive an annual influenza vaccination as a condition of their employment. This forthright and novel decision by VMMC leaders and vaccination program champions to emphatically emphasize the importance of influenza vaccination of HCWs has opened the door to a new approach to increasing patient safety as well as HCW protection.

For over 2 decades, HCWs have been recommended as specific targets for influenza vaccination because of their close interactions with persons at high risk for influenza-related complications.[5] HCWs can serve as vectors for healthcare-associated influenza, may shed the influenza virus before the onset of symptoms, and may not present with classic influenza-like illness, thereby leading HCWs to believe that their respiratory symptoms are not due to influenza infection. Before the 2009–2010 influenza season, despite increased awareness of the importance of influenza vaccination of HCWs and large-scale, resource-intensive vaccination campaigns at most healthcare facilities, vaccination rates remained at approximately 45%. Last year, probably because of increased concern regarding the emerging novel H1N1 influenza A pandemic and the early availability of seasonal influenza vaccine, nearly 62% of HCWs reported receiving the seasonal influenza vaccine. Whether this substantial increase in uptake of the seasonal vaccine heralds a sustained increase or is merely an isolated event remains to be seen.

Healthcare facility vaccination programs for HCWs traditionally employ a myriad of strategies and invest extensive resources with the aim of improving HCW vaccination coverage in order to protect patients, HCWs, and other close contacts. Unfortunately, very few healthcare facilities have reported HCW influenza vaccination rates above 70%, even with the use of multifaceted, intensive programs. Despite having an HCW influenza vaccination rate above the national average, in 2004, VMMC vaccination program managers and facility leaders were dissatisfied with HCW compliance with what they believed was an important and effective intervention to improve the safety of their patients. This is when VMMC made an important and innovative first step toward a new model for HCW influenza vaccination programs.

As described by Rakita et al,[4] most of the VMMC HCW influenza vaccination program did not differ dramatically from other multifaceted vaccination programs at other healthcare institutions. Vaccine was provided free of charge in conjunction with a highly visible publicity campaign that included trained advocates (or "champions"), incentives, and kickoff events. HCWs could receive vaccine via a mobile cart or from peer vaccinators, including during nights and weekends. But the VMMC program also had some rather innovative aspects. The most substantial was the requirement that all persons working at VMMC were required to receive an annual influenza vaccination as a condition of their employment, with only medical and religious exemptions allowed. Importantly, the VMMC program encompassed *all* persons who worked at the medical center, not just those under direct employment. Several studies have documented the variabili-

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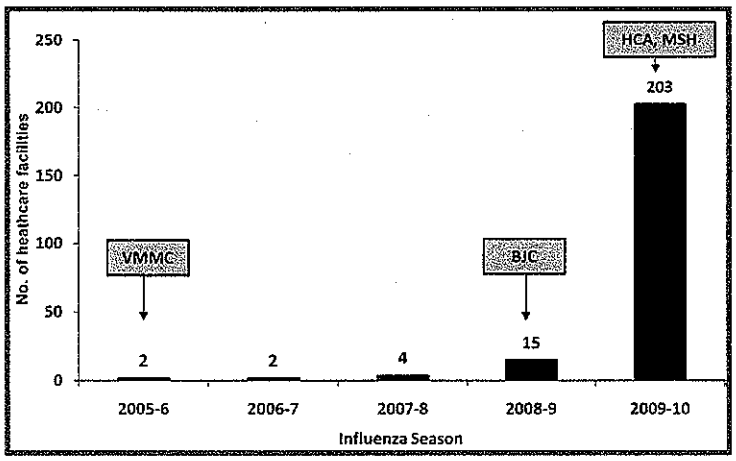

FIGURE 1. Cumulative number of healthcare facilities implementing a mandatory healthcare worker (HCW) influenza vaccination program. The boxes above the bars designate when organizations highlighted in the article began implementation of a mandatory HCW influenza vaccination program. The sources of our data were survey reports from the Immunization Action Coalition,[9] the University HealthSystem Consortium,[10] and the Emerging Infections Network.[11] BJC, BJC Healthcare; HCA, Hospital Corporation of America; MSH, MedStar Health; VMMC, Virginia Mason Medical Center.

ty among healthcare facilities in terms of which HCWs are specifically targeted and included in influenza vaccination programs.[6,7] Groups of HCWs who may have direct patient care but are not directly employed by a facility, such as affiliated physicians, students, and volunteers, may not be included in vaccination programs. VMMC leaders argued that, to be a fair and just policy, such persons must be included in this comprehensive patient safety program. Even those persons without direct patient care as part of their duties were included, because of their potential for spreading a contagious respiratory pathogen to coworkers who did have such contact with patients. The VMMC leaders also put their "money where their mouth was," offering free allergy testing for those with reported egg allergies and reimbursing HCWs for the costs of influenza vaccination received from a non-VMMC provider.

The impact of their program was impressive. HCW influenza vaccination rates reached 97% in the program's first year and have been sustained above 98% for the past 4 influenza seasons. Quite simply, the requirement for HCW to receive an annual influenza vaccine has become a basic reality of working at VMMC, ingrained in the larger culture of a high-quality healthcare institution. Seven employees left VMMC during the program's first year; only 2 left in the following 4 seasons.

The impact of the mandatory program on other outcomes was difficult to establish. Rakita et al[4] did not report an assessment of healthcare-associated influenza before and after program implementation; this may not be surprising, because detailed prospective surveillance of this outcome occurs infrequently at most healthcare institutions.[7] VMMC staff satisfaction improved after the institution of the new vaccination requirements; however, one cannot directly attribute this increase to the mandate given the many factors that can affect employee satisfaction. Importantly, it is encouraging nonetheless that staff satisfaction did not decline after implementation of the program. Rakita et al[4] also examined whether the new program affected employee sick leave. Overall employee sick leave in January and February did not decline significantly after the introduction of the program. The measurement of overall sick leave in this analysis was a crude metric that was affected by many factors. An analysis using the actual time of peak influenza activity in the region may have provided a more accurate assessment of sick leave due to influenza. During the 5 influenza seasons following the implementation of the influenza vaccination program at VMMC, peak influenza activity occurred in January or February during most years. However, the peak of influenza activity in region 10 (which includes the states of Washington, Oregon, Idaho, and Alaska) occurred in mid-March during the 2008–2009 season and in September during last year's early second wave of novel H1N1 influenza A.[8] Examining sick leave data from January and February of each year may have underestimated any impact of the mandatory influenza vaccination program on employee absenteeism.

With VMMC leading the way, an increasing number of healthcare facilities and health systems have implemented programs in which HCW influenza vaccination is a condition of employment (Figure 1). In 2008, BJC Healthcare, a system of 11 acute care and 3 extended care facilities around St. Louis, Missouri, increased their HCW influenza vaccination coverage from 71% before the implementation of the mandate to 98.4% in the first season after the mandate. Nearly 26,000 BJC Healthcare employees were vaccinated, and 8 were terminated.[12] This past season, several more healthcare facilities started mandatory vaccination programs. The Hospital

Corporation of America required influenza vaccination for all of its nearly 140,000 employees in over 160 healthcare facilities throughout the United States. Their HCW influenza vaccination rate last year was 96.4%.[13] The MedStar Health system of 9 facilities in Maryland and the District of Columbia achieved an influenza vaccination rate of 98% of their approximately 26,000 employees and affiliated HCWs (including a 95% vaccination rate among affiliated physicians) after implementing a mandatory vaccination program (L. V. Karanfil [corporate coordinator, infection control, MedStar Health], personal communication; by e-mail, March 16, 2010). In 2009, the state of New York became the first state to require influenza vaccination of HCWs, although vaccine shortages and confusion regarding the novel H1N1 vaccine led to a suspension of this regulation.[14] Increasingly, healthcare institutions have moved to mandatory influenza vaccination programs or are strongly considering implementing such programs for the upcoming 2010–2011 influenza season. Arguably, many of these organizations would not have taken this step if they had not had the successful example of VMMC to emulate.

Innovators also face new challenges. In VMMC's case, these primarily arose from grievances raised by the Washington State Nurses Association (WSNA). WSNA noted that implementing a new requirement for employment at VMMC required negotiation as part of their collective bargaining agreement, which had not occurred. In a later WSNA challenge against the VMMC requirement for nonvaccinated HCWs to wear masks while at work, the court ruled that such an intervention was allowed as part of VMMC infection control policies. It is important to note that the major impetus for the challenge was not driven by an "antivaccine" stance, which the WSNA injunction has occasionally been described as.[15] The fact that 96% of VMMC's unionized nurses received an influenza vaccine last year reinforces the notion that the WSNA's concerns were not a referendum against influenza vaccination of HCWs.

As with most intensive programs that must engage a large number of individuals, the VMMC vaccination program was resource intensive, including costs spent challenging the WSNA litigation. Clearly, senior leadership as well as financial and personnel support are essential for a successful mandatory vaccination program. Many healthcare facilities already utilize extensive resources to encourage, convince, cajole, and beg their HCWs to receive an annual influenza vaccination. One must question whether some of the costs associated with implementing a mandatory program are already being utilized with less impact in voluntary vaccination programs. Importantly, as the expectation for influenza vaccination became hardwired as part of the VMMC's larger culture of safety, the process became more efficient and less resource intensive.

Although the discussions surrounding mandatory HCW influenza vaccination that were first prompted by the VMMC are rather new, this debate strikingly mirrors past debates about childhood vaccination programs. Despite extensive and expensive efforts, voluntary programs aimed at increasing the rate of childhood vaccination resulted in a plateau of coverage at approximately 65%, a percentage that was inadequate to prevent continued circulation of the targeted pathogens. The decision to require vaccination for day care and school entry was made, which finally led to the high rates of vaccination coverage noted today in the United States.[16,17]

With the growing interest in implementing similar programs, the HCW influenza vaccination program, after years of extensive efforts that resulted in only a modest increase in coverage, now may follow the effective course taken by childhood vaccination programs and school entry requirements. Low HCW influenza vaccination rates can no longer be tolerated, because our patients and our coworkers are at risk. Combining a mandatory HCW influenza vaccination policy with a multifaceted infection control program—which includes early identification of infected patients, source control, use of isolation precautions and personal protective equipment, restriction of ill HCWs and visitors, and other environmental controls—can reduce transmission of influenza in healthcare settings and represents a new model of influenza infection control. For effectively implementing a mandatory HCW influenza vaccination program, we can applaud the role that VMMC has played in pioneering another important infection control "first."

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