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ORIGINAL ARTICLE

Influenza Vaccination among Healthcare Workers: Ten-Year Experience of a Large Healthcare Organization

M. Cristina Ajenjo, MD; Keith F. Woeltje, MD, PhD; Hilary M. Babcock, MD, MPH; Nancy Gemeinhart, RN, MHA; Marilyn Jones, RN, MPH; Victoria J. Fraser, MD

OBJECTIVE. To describe the results of different measures implemented to improve adherence to the healthcare worker (HCW) influenza immunization program at BJC HealthCare during the period from 1997 through 2007.

DESIGN. Descriptive retrospective study.

SETTING. BJC HealthCare, a 13-hospital nonprofit healthcare organization in the Midwest.

METHODS. We reviewed and analyzed HCW influenza vaccination data from all BJC HealthCare Occupational Health Services and hospitals during the period from 1997 through 2007. Occupational health staff, infection prevention personnel, and key influenza vaccination campaign leaders were also interviewed regarding implementation measures during the study years.

RESULTS. At the end of 2007, BJC HealthCare had approximately 26,000 employees. With the use of multiple progressive interventions, influenza vaccination rates among BJC employees increased from 45% in 1997 to 72% in 2007 ($P < .001$). The influenza vaccination rate in 2007 was significantly higher than in 2006: 72%, compared with 54% ($P < .001$). Five hospitals had influenza vaccination rates that exceeded the target goal of 80% in 2007. The most successful interventions were adding influenza vaccination rates to the quality scorecard incentive program and the use of declination statements, both of which were implemented in 2007. The most important barriers to success identified by interview respondents were HCWs' misconceptions about influenza vaccination and a perceived lack of leadership support.

CONCLUSIONS. Influenza vaccination rates among HCWs significantly improved with multiple interventions over the years. However, the BJC HealthCare influenza vaccination target of 80% was not attained at all hospitals with these measures. More aggressive interventions, such as implementing mandatory influenza vaccination policies, are needed to achieve higher vaccination rates.

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Influenza is a serious viral respiratory illness that causes annual epidemics worldwide, resulting in more than 200,000 hospitalizations and 36,000 deaths per year in the United States.[1,2] The estimated economic impact of influenza is $3 billion to $10.4 billion in annual direct costs.[3,4] Some populations, such as the elderly, inmunocompromised individuals, critically ill patients, and young children, are at particular risk of influenza complications, especially in healthcare settings.[2,5,6] Multiple studies have shown that infected healthcare workers (HCWs), both symptomatic and asymptomatic, can transmit influenza to their vulnerable patients. Healthcare-associated influenza outbreaks are well documented.[5,7-11]

Influenza vaccination of HCWs has been shown to reduce transmission of influenza in healthcare settings, reduce employee illness and absenteeism, and decrease influenza-related morbidity and mortality among persons at increased risk for complications during influenza season.[12-18] Although this evidence comes primarily from long-term care facilities, transmission of influenza from HCWs to patients can also occur in acute care facilities. Thus, immunization of HCWs against influenza would be expected to significantly reduce the risk in acute care settings as well.

Current guidelines from the Healthcare Infection Control Practices Advisory Committee, the Advisory Committee on Immunization Practices, the Society for Healthcare Epidemiology of America, and other professional organizations strongly recommend annual influenza vaccination for HCWs.[7,19,20] One of the US national health objectives for 2010 is to achieve HCW vaccination coverage levels of 60%. Despite these recommendations, rates of HCW influenza vaccination reported from different institutions remain low, with a national average of about 40%.[7,21,22] Different measures to improve influenza vaccination rates among HCWs have been proposed and evaluated.[7,23] These measures include offering

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free influenza vaccination at convenient work sites, providing HCWs with education regarding the benefits and potential health consequences of influenza illness, providing modeling and support for influenza vaccination by institutional leaders, and requiring signed declination statements from those who decline influenza vaccination. These initiatives have been demonstrated to moderately increase HCWs' acceptance of influenza vaccination.[7,24-30]

Some influenza vaccination interventions in past studies have been bundled, making it difficult to evaluate the effect of each aspect of the intervention. In one study,[26] providing vaccination in locations and at times easily accessible by HCWs (mobile carts) significantly improved influenza vaccination acceptance from 44% to 66%. Providing education about influenza immunization substantially increased the rate of HCW influenza vaccination from 45% to 60% in 1 study.[26] Modeling by leadership was reported to significantly increase influenza vaccination rates among employees.[29] Polgreen et al[30] recently reported a mean increase of 11.6% in influenza vaccination rates with the use of declination statements.

BJC HealthCare has used a comprehensive HCW influenza vaccination program since 1997 to increase annual vaccination rates. In 2007, a target goal of at least 80% influenza vaccination rate among employees was set. This article describes the results of different measures implemented by BJC HealthCare to improve adherence to the employee influenza immunization program during the period from 1997 through 2007.

METHODS

Design

Aggregated data collected from the BJC Occupational Health Services database records during the period from 1997 through 2007, and structured interviews of the key leaders and key participants of the annual employee influenza vaccination campaigns, were used to evaluate the employee influenza vaccination program. The interviews contained 9 open-ended questions to assess each individual's perspective regarding successful interventions and barriers to improving influenza vaccination rates. The data were reviewed for the baseline period of 1997–2000 and for 2 intervention periods: 2000–2004 and 2005–2007. During these 2 intervention periods, additional influenza campaign initiatives were implemented to improve vaccination rates.

Setting

BJC HealthCare is one of the largest nonprofit healthcare organizations in the midwestern United States, delivering services to residents primarily in the greater St Louis, southern Illinois, and mid-Missouri regions. The organization includes 13 hospitals and more than 3,200 staffed beds. Two of the facilities are academic acute tertiary care hospitals affiliated with Washington University in St. Louis School of Medicine: 1 adult hospital with 1,252 staffed beds and 1 pediatric hospital with 250 staffed beds. Four are large community hospitals, and 7 are small suburban or rural hospitals (each with fewer than 100 staffed beds). Twelve of the current 13 BJC HealthCare hospitals were included in the analysis. The 13th hospital is a small rural facility that is under a different management structure than all of the other facilities. This hospital did not participate fully in the influenza vaccination program and therefore was excluded. Data from BJC HealthCare–associated extended care facilities and home health care were also excluded. Extended care and home health care were excluded from this analysis because influenza vaccination record keeping was incomplete for all study years. All types of hospital employees defined as contracted personnel were included. The approximately 4,600 credentialed private physicians are offered free influenza vaccination, but their vaccination rates were not tracked by BJC HealthCare because they are not hospital employees, so they were not included.

BJC HealthCare occupational health programs and procedures are standardized across the organization through the Council of Occupational Health Professionals. Each facility's occupational health representative participates in bimonthly meetings that include education and standardization of occupational health and safety surveillance and interventions. Each facility uses the BJC occupational health database computerized network to track employee vaccinations, injuries, and exposures.

Statistical Analysis

Influenza vaccination rates are expressed as the number of staff vaccinated per 100 employees. Vaccination rates were compared with the use of the Student *t* test for continuous variables. A *P* value of less than .05 was considered to indicate a statistically significant result.

RESULTS

BJC HealthCare has historically provided influenza vaccination free to all BJC employees during annual campaigns as part of its occupational health and infection prevention policy. Data regarding rates of influenza vaccination have been recorded since 1997. At the end of 2007, the organization had approximately 26,000 employees, including 900 physicians in training (fellows, residents, and interns). Each hospital had 308–8,745 HCW employees.

Figure 1 shows BJC HealthCare's employee influenza vaccination rates during the period from 1997 through 2007. In 1997, the rate was 45%, compared with 72% in 2007 ($P < .001$). The rate in 2007 was significantly higher than in 2006: 72%, compared with 54% ($P < .001$). Each year, a target influenza vaccination rate was set by occupational health staff. The target goals of influenza vaccination rates for all BJC HealthCare staff were incrementally increased each year, from 45% in 2002 to 80% in 2007. The target vaccination rate was attained only in 2002, in which the overall influenza vaccination rate among the 12 hospitals was 46%. However, the

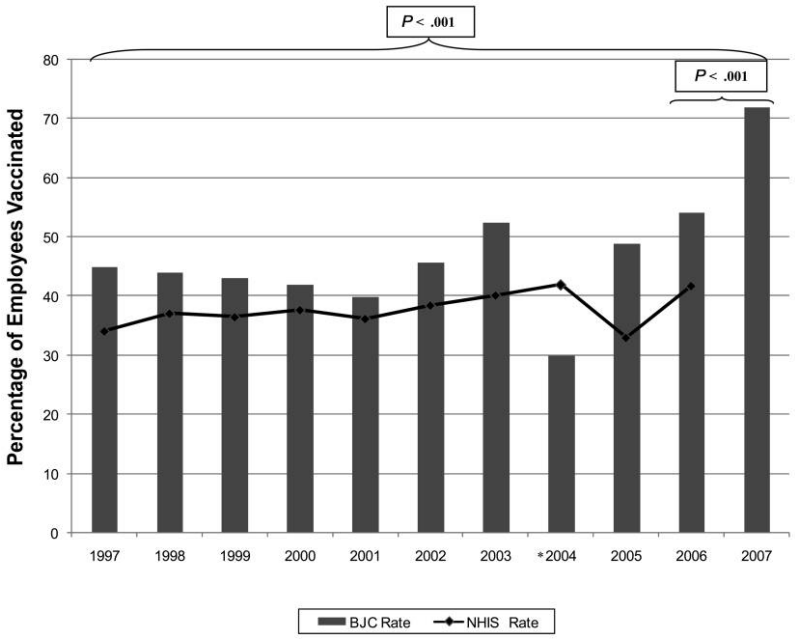

FIGURE 1. Employee influenza vaccination rates at BJC HealthCare, 1997–2007. NHIS, National Health Interview Survey (healthcare workers subgroup).[31] *Influenza vaccine shortage occurred in 2004.

observed BJC employee vaccination rates were always above the National Health Interview Survey influenza vaccination rates,[31] except in 2004, which was the year of the influenza vaccine shortage. Five hospitals had influenza vaccination rates of more than 80% in 2007 (Figure 2). Three of the hospitals with employee influenza vaccination rates that exceeded 80% are small suburban or rural hospitals (each with fewer than 100 staffed beds), and 2 are community hospitals (with 350 or fewer staffed beds). The influenza vaccination rate at the large, adult, teaching hospital increased from 32% in 1997 to 62% in 2007 ($P < .001$).

Table 1 summarizes the interventions implemented to im-

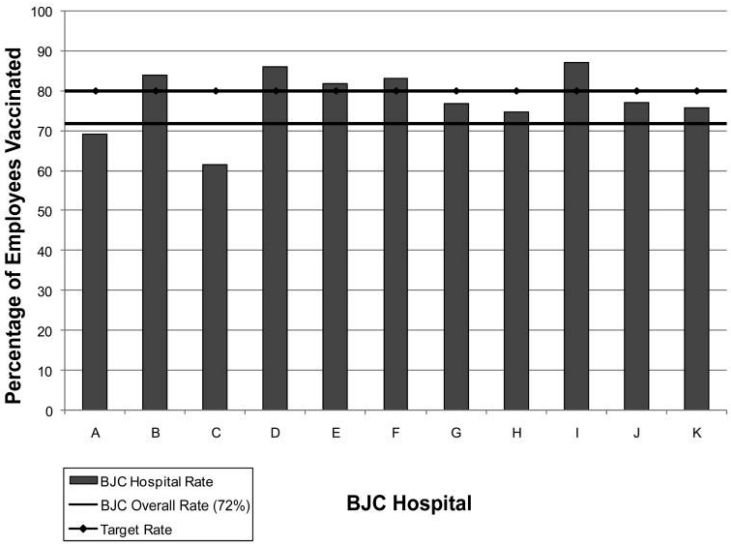

FIGURE 2. Influenza vaccination rates by hospital for 11 hospitals in the BJC HealthCare system, 2007. Staff sizes: hospital A, 793 employees; hospital B, 1,927 employees; hospital C, 8,745 employees; hospital D, 923 employees; hospital E, 507 employees; hospital F, 2,092 employees; hospital G, 342 employees; hospital H, 2,681 employees; hospital I, 560 employees; hospital J, 308 employees; hospital K, 2,600 employees.

TABLE 1. Interventions Implemented to Improve Healthcare Worker Influenza Vaccination Rates at BJC HealthCare, 1997–2007

Period	Policy	Access to vaccination	Education	Leadership involvement	Incentives[a]	Marketing	Campaign Theme
Before 2000 baseline period	Free influenza vaccination for all BJC employees	OH office	Lectures for house staff, posters	IP director, OH director	Trinket incentives such as badge holders	E-mail announcements	None
2000–2004	Free influenza vaccination for all BJC employees; centralized promotion; 2003: Best Practice[b] was developed; 2004: influenza vaccine shortage, with vaccination based on priorities and LAIV availability	Focus on accessibility: on-site vaccination	Posters and communication forums, announcements, BJC newspaper article	IP director, OH director, hospital epidemiologists	Pens, buttons, candy; 2002 and 2003: cash incentives of up to $1,000	Catchy slogans, posters, published results, e-mails	2002–2003: "Flu Survivor"
2005–2007	Free influenza vaccination for all BJC employees; promotion at all organization levels; system comparative data to promote friendly competition; 2007: influenza vaccination rate included Best in Class[c] scorecard; declination statements; LAIV offered	Vaccination given at multiple sites, at work site, cafeteria, halls; on multiple dates and times; extra volunteer nurses giving shots; roving vaccination carts; extended vaccination period to end of February	Additional influenza vaccine education: mailed and e-mailed letter, posters, lectures, BJC newspaper article	IP and OH directors, hospital epidemiologists, feedback to managers and senior hospital leadership	Pins, pens, magnets, key chains; raffle prizes: iPods, cash, gift baskets to shifts with best vaccination rates	Signs, posters; 2006: MBTV announcements[d]; 2007: photos of key leaders at each location receiving their vaccinations	2005: "Flu Free at BJC" 2006: "Dare to Care—Avoid the Flu" 2007: "Got My Shot"

NOTE. OH, occupational health; IP, infection prevention; LAIV, live attenuated intranasal vaccine.

[a] Incentives provided by BJC hospitals were different across the system during these 3 periods.

[b] Best Practice is an OH policy outlining best practices for all BJC HealthCare facilities to maximize distribution of influenza vaccine.

[c] "Best in Class" scorecard is a BJC HealthCare quality report that is used to provide leadership at each hospital with incentives based on reaching preestablished targets.

[d] MBTV announcements are promotional messages displayed on television monitors in waiting rooms, hallways, and public areas.

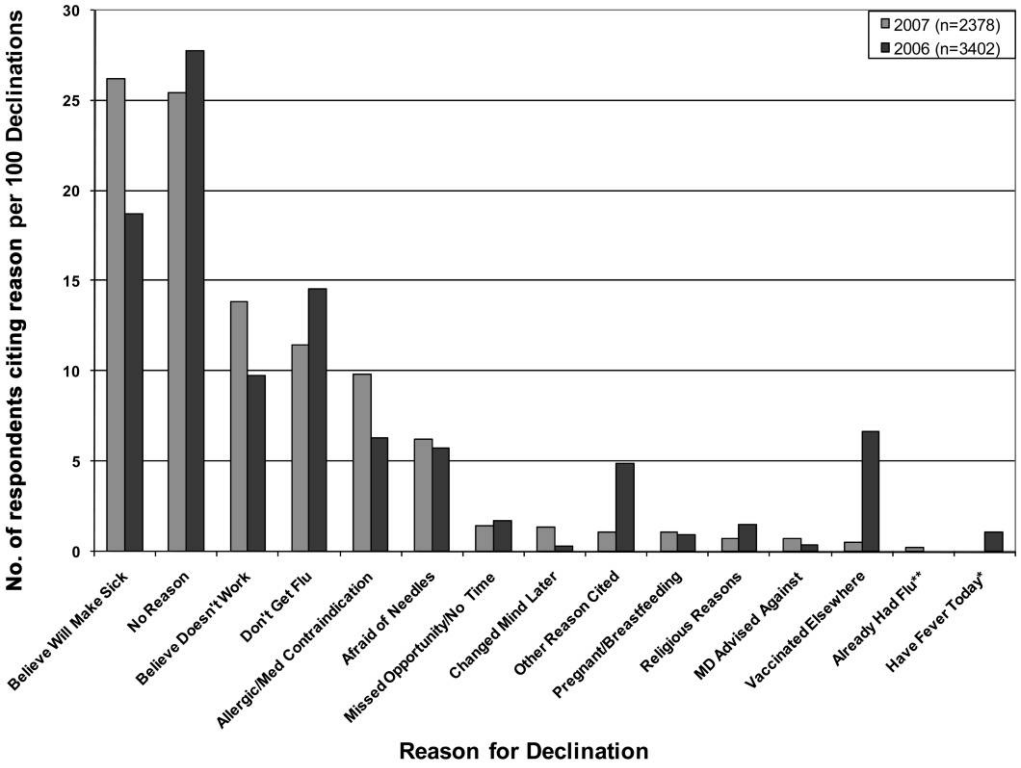

FIGURE 3. Reasons that employees declined influenza vaccination at BJC HealthCare facilities, 2006–2007. *Question only asked in 2006. **Question only asked in 2007.

prove the rate of HCW influenza vaccination. Before 2000, influenza vaccination was given only at occupational health offices, and leadership involvement included only the occupational health and infection prevention directors at each facility. Education consisted of lectures for house staff and posters in patient care areas. E-mail announcements were used as part of basic influenza vaccination marketing. No specific campaign themes were used. During the period from 2000 through 2004, BJC HealthCare increased its focus on making influenza vaccination more accessible to HCWs, and on-site influenza vaccination was started. BJC HealthCare also began using standardized promotion materials for all hospitals, including more education and marketing activities and materials, such as posters, communication forums, catchy slogans, e-mails, and publishing employee influenza vaccination adherence results. Multiple incentives, including trinket incentives (pens, buttons, and candy) and cash lotteries, were also used during this time frame by many of the individual hospitals.

In 2003, the BJC HealthCare influenza vaccination "Best Practice" policy was developed. The Best Practice influenza policy outlined the best practices for all BJC facilities to use to optimize the distribution of influenza vaccine. In 2004, there was a shortage of influenza vaccine, so that year influenza vaccination was focused only on high-priority HCWs, that is, those most likely to be exposed to influenza who were caring for the highest risk patients. The high-priority group included physicians and nurses working in the emergency department, intensive care units, and pediatric, obstetric, and medicine wards. Live attenuated intranasal vaccine was also made available to eligible HCWs.

During the period from 2005 through 2007, access to influenza vaccination was further enhanced by giving the vaccination at multiple work sites, as well as in other high-traffic locations, such as the cafeteria and hallways, and at physician grand rounds and other clinical conferences. Influenza vaccine promotion was heightened at the organization and facility level with the use of of several new marketing strategies, including unique campaign themes and multiple incentives. Hospital vaccination rates were reported to all the BJC HealthCare hospitals to promote friendly competition between the facilities. Vaccination adherence data were provided to managers and administrators at each hospital. Senior leadership support for the influenza vaccination campaigns was also promoted.

In 2007, two additional important interventions were implemented: any employee who declined to receive vaccination was required to sign a declination statement, and employee influenza vaccination rates were reported on the "Best in Class" scorecard. Financial incentives for leadership at each hospital are based on reaching preestablished targets on metrics that are reported on the BJC HealthCare Best in Class

TABLE 2. Perceptions of Successful Interventions and Barriers to Improving Healthcare Worker (HCW) Influenza Vaccination Rates Identified from Structured Interviews about HCW Influenza Program

Successful interventions
Free vaccination
Professional marketing
Roving vaccination carts
Multiple dates and times for vaccination (vaccination readily available and easy to access at work site)
Including influenza vaccination in the Best in Class scorecard[a]
Competition between BJC facilities to achieve higher vaccination rates
Any support by leadership
Senior leadership support
Declination statements
Less successful interventions
Incentives, including prizes and cash
Inconsistent follow-up of noncompliant HCWs
System-level tokens and incentives
Education
Barriers to success
HCW fears
HCW misconceptions about influenza vaccine's efficacy, benefits, and toxic effects
Inconvenient vaccination administration site
HCWs' lack of knowledge regarding influenza consequences
Variety of shifts; part-time employees
Tracking compliance data
Time required
Lack of leadership support

NOTE. Boldface text shows perceptions mentioned by more than 1 interviewed participant.

[a] "Best in Class" scorecard is a BJC HealthCare quality report that is used to provide leadership at each hospital with incentives based on reaching preestablished targets.

scorecard. The influenza target vaccination rate was at least 80% for all facilities. In 2007, the overall influenza vaccination rate for BJC HealthCare employees was 72%, which was a 17% increase from 2006 (Figure 1). Implementing the declination statements and influenza vaccination reporting on the Best in Class scorecard required additional time and effort from occupational health, infection prevention, and other nursing personnel working on the influenza campaigns. Those interviewed indicated that a substantial amount of extra time and effort was spent on the influenza campaign in 2007 compared with earlier years, although there were no formal efforts to track the resources used for the influenza vaccination campaign during the study period. Collecting declination statements was noted to be particularly labor intensive.

The reasons that employees cited for declining influenza vaccination were tracked at all BJC HealthCare facilities in 2006 and 2007 (Figure 3). The most common reasons for declining vaccination were "believe vaccine will make sick," "no reason," "believe vaccine does not work," and "I do not get the flu." "Religious reasons," "medical doctor advised against," and "already had flu" were reasons occasionally given (by <1% of respondents). Only 56% of HCWs who did not receive vaccination actually signed a declination statement.

Table 2 shows the results of the structured interviews about the successes and barriers of the influenza vaccination program. The most successful interventions identified were inclusion of the influenza vaccination rates on the Best in Class scorecard, acquiring leadership support, and use of declination statements. Barriers mentioned frequently in the interviews were HCWs' misconceptions about influenza vaccine efficacy, benefits, and toxic effects; and lack of leadership support.

DISCUSSION

The principal finding of this study was the significant improvement in rates of influenza vaccination among BJC HealthCare staff over the years with progressive implementation of multiple interventions. Despite numerous interventions, the 2007 goal of an 80% vaccination rate for all BJC HealthCare facilities was reached by only a few hospitals in the organization. The facilities whose vaccination rates exceeded 80% are small rural or community hospitals with a limited number of employees (308–2,092 persons). The relatively small size of the staff at these hospitals undoubtedly facilitated the vaccination process and required fewer resources to achieve better vaccination rates. The lowest vaccination rate through the years occurred at the largest academic tertiary care hospital in the organization, which has more than 8,700 employees and only 3 occupational health nurses.

However, at this hospital more than 5,300 employees received vaccination in 2007. The actual number of employees who received vaccination at the largest hospital was greater than the number of employees who received vaccination at the 5 smaller hospitals combined. Providing vaccination to large numbers of employees requires greater resources and time than providing vaccination to small numbers of employees.

The largest increase in employee influenza vaccination rates was observed between 2006 and 2007. This increase coincided with the implementation of declination statements and the inclusion of employee influenza vaccination rates on the BJC HealthCare Best in Class scorecard. Both of these interventions were implemented in the same year, so it is difficult to distinguish the effect of each intervention separately. HCWs were required either to receive the influenza vaccination or to sign a declination statement; however, there were no penalties for employees who did not comply, and not all unvaccinated HCWs filled out a declination form. The observed increase in vaccination rates was higher than the mean increase reported by other investigators who have tracked rates after the introduction of declination statements,[30] which may reflect the contribution of additional leadership support ob-

tained because of the financial incentives established by reporting vaccination rates on the BJC HealthCare Best in Class scorecard.

The most frequently cited reasons for declining influenza vaccination were related to HCWs' misconceptions and fears regarding influenza vaccine's efficacy, benefits, and toxic effects. This finding was also identified in the key participant interviews and has been consistently reported by other investigators.[27,32,33] Unfortunately, it was not possible to completely reverse HCWs' misconceptions despite substantial educational efforts. Education was perceived as a less successful intervention in the structured interviews, probably because provision of education did not always translate into vaccine acceptance. Some investigators have reported that participation in structured in-service education or conferences was associated with improvement in vaccination rates.[24,26,28,34,35] Developing leadership support was perceived as a successful intervention in the structured interviews and has also been associated with higher vaccine acceptance rates among staff members under their leadership in the literature.[36-38]

There are some limitations to this study. First, we were unable to obtain complete data for the years before 2000. Some data were obtained from the structured interviews, which may not be completely accurate because of the subjective nature of these data, reliance on participants' memory, and the potential for recall bias. We were unable to obtain specifics about employee job titles in different facilities, and the influenza vaccination acceptance rate among students was not tracked. Regarding influenza vaccination rates among physicians, this study includes only physicians who were employed by BJC HealthCare, primarily residents and fellows. Physicians in private practice or employed by Washington University in St. Louis School of Medicine were not officially tracked by BJC Occupational Health Services. The generalizability of these findings may be limited because of the complexity of this healthcare organization and the extent of leadership support and occupational health and infection prevention resources.

Despite significant improvement in rates of influenza vaccination among HCWs due to multiple interventions implemented over several years, the BJC HealthCare influenza vaccination target rate of 80% was not fully achieved. New interventions are needed to achieve higher vaccination rates. Mandatory influenza vaccination, including penalties for noncompliance, has been recommended by some experts as a logical step to ensure high HCW vaccination rates and protect patients from influenza. A recent survey of nurses from the Mayo Clinic reported that 56% of respondents stated that mandatory influenza vaccination was appropriate for HCWs.[39] Virginia Mason Medical Center in Seattle, Washington, reported a 98.5% overall influenza vaccination rate among employees with the use of mandatory influenza vaccination (P. Crome, written communication, March 2007). Because BJC HealthCare staff vaccination goals were not met in 2007 despite substantial efforts and because influenza vaccination of HCWs was viewed as an important patient safety issue, BJC HealthCare implemented mandatory influenza vaccination for employees in 2008. The initial results of the mandatory influenza vaccination program at BJC were encouraging, as 98% of HCWs received influenza vaccination in the fall of 2008.[40] A more detailed description of the implementation and follow-up of the mandatory influenza vaccination program is currently in progress.

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