American Journal of Infection Control 41 (2013) 824-30

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Prevalence and factors associated with 2009 to 2011 influenza vaccinations at a university medical center

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Key Words:
Influenza
Employees
Medical center
Occupational health
Pandemic
University
Vaccination

Background: Information on the rates and factors associated with influenza vaccinations, although limited, is important because it can inform the development of effective vaccination campaigns in a university medical center setting.

Methods: A study was conducted in 2011 to identify individual and organizational level barriers and facilitators to influenza vaccination among clinical and nonclinical personnel (N = 428) from a major university medical center.

Results: Seventy-one percent of clinical personnel (n = 170) reported pandemic H1N1 vaccination compared with 27% of nonclinical personnel (n = 258), even though vaccine was made widely available to all personnel at no cost. Similarly, disparate rates between clinical and nonclinical personnel were noted for the 2009/2010 seasonal influenza vaccine (82% vs 42%, respectively) and 2010/2011 combination (pandemic plus seasonal) influenza vaccine (73% vs 28%, respectively). Factors associated with pandemic vaccination in nonclinical personnel included the following: high level of influenza-related knowledge, concern regarding influenza contagion, history of previous influenza vaccinations or influenza illness, participation in vaccine-related training, and awareness of the institution's written pandemic plan. For clinicians, past history of seasonal influenza vaccination was associated with pandemic vaccination. For all participants, taking any 1 or more of the 3 influenza vaccines available in 2009 to 2011 was associated with intent to take a hypothetical future novel pandemic vaccine (odds ratio, 6.7; 95% confidence interval: 4.32-10.44; $P < .001$).

Conclusion: Most of the risk factors associated with lack of vaccination uptake are amenable to organizational strategies.

A high fatality pandemic influenza event could result in a public health emergency of major proportions.[1,2] Whereas the 2009 pandemic influenza A H1N1 (pH1N1) virus was relatively mild, with a case fatality rate more typical of seasonal influenza, influenza viruses are known to be highly unpredictable. Based on modeling and data from the 1918 pandemic and in consideration of the vast health care improvements now at our disposal, the Centers for Disease Control and Prevention (CDC) projected that, during a serious, highly lethal pandemic, 30% of the population could become ill, with 22% of these requiring hospitalization, and an overall fatality rate of 2%.[3] In New York City (with a population of 8.2 million), based on these estimates, 2.46 million people could become ill, 541,000 may be hospitalized, and 49,200 might die.[3]

Because new strains of influenza are constantly evolving, with vaccination providing limited or no protection among strains, the CDC recommends that the general public receive annual vaccination against influenza as soon as that season's vaccine becomes available, generally beginning in August each year.[3,4]

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This paper does not represent the opinions of the University Medical Center with which the authors are associated but reflects the views of the authors based on the study data as collected and analyzed.

Conflicts of interest: None to report.

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http://dx.doi.org/10.1016/j.ajic.2012.11.020

To reduce worker morbidity, mortality, and absenteeism and to decrease risk of transmission to patients,[5] the CDC and many associations and organizations (eg, Advisory Committee on Immunization Practices [ACIP], the Society for Healthcare Epidemiology, the Association for Professionals in Infection Control, and the Infectious Disease Society of America) all strongly endorse health care worker (HCW) influenza vaccination.[6]

Increasingly, *all* personnel affiliated with major university medical centers are urged to take seasonal influenza vaccines.[7,8] This is not only because the increasing interdisciplinarity between schools can lead to outbreaks but because of the need to maintain a fully functioning interdependent research enterprise infrastructure. Students, faculty, staff, and patients all comingle in many of these institutions. This is especially notable among dental, nursing, and medical schools as they more closely align themselves into integrated care delivery systems. Each season, as soon as the influenza vaccine is made available, most major university medical campuses implement widespread vaccination campaigns that target as many personnel as possible.

During the pPH1N1 pandemic influenza event in the United States, this was especially challenging. The pH1N1 pandemic vaccine, first approved by the Food and Drug Administration on September 15, 2009, was initially in short supply, and therefore was at first made available only to "at risk" groups or to those caring for "at risk" groups.[4,9,10] Initially, demand far exceeded supply, and medical centers had to rely on nonpharmaceutical interventions with a heavy emphasis on infection control precautions to prevent spread, although social isolation and distancing was also relied on. For example, "a probable case" of pandemic strain influenza in a dental student at Harvard University led to not only a shutdown of the dental school's treatment clinic but to the temporary suspension of classes at all 3 of Harvard's major schools on its medical campus and the cancellation of classes for all third-year, fourth-year, and postdoctoral students.[11]

By January 2010, production increased to the point that the pH1N1 influenza vaccine could be made widely available, but, by then, it was clear that this pandemic strain was not resulting in the level of severity of disease as had been initially feared, and demand lessened. By September 2010, a new combination vaccine, which provided protection against *both* the pandemic pH1N1 strain as well as the seasonable influenza strain, was made available.[12]

The supply chain problems, combined with some initial concerns related to the rapid development of this new vaccine, may have dampened uptake of pandemic vaccine in university medical centers, but even seasonal influenza vaccination rates among health care personnel (HCP) are generally quite low.[6,13,14] Influenza vaccination compliance rates among US HCP have been shown to be quite low, with rates of 34% and 35% in 1997 and 2001, respectively. More recently, Babcock et al[6] and Pavia[13] reported HCW influenza vaccination rates of 42% and 44% during the 2005/2006 and 2006/2007 influenza seasons, respectively. Few influenza vaccination rate studies have reported on both clinical and nonclinical personnel. Regardless of the strain of influenza, the US National Health objectives for 2020 include a HCW influenza vaccination rate of 60%.[9]

Many barriers to vaccination must be overcome to reach this vaccination goal. As reported by Nowalk et al[15] and others,[16] barriers to vaccination are explained by the Health Belief Model (Rosenstock 1974)[17] and include the following: inconvenience, cost, low awareness of disease severity, fear of adverse effects, fear of needles, and belief that the flu shot can cause disease. Facilitating factors that have been noted include interest in self-protection, concern for patients' well-being, belief in the vaccine's effectiveness, reduction in sick leave, and trust in employee health service's recommendations.[15] There is limited information regarding barriers and facilitators to influenza vaccination in the context of a pandemic outbreak, although a few studies including 1 US study (Hakim et al 2011)[18] on pH1N1 vaccination uptake in HCWs have been published.[16] Information on uptake rates and factors associated with pH1N1 in a medical center might be informative in terms of future pandemic preparedness planning. This study was designed to identify the factors influencing vaccination during the 2009/2010 and 2010/2011 influenza seasons at a major university medical center.

METHODS

Study populations and study sites

Study participants included clinical and nonclinical personnel, including workers from public safety and facilities management, affiliated with a large university medical center. Participants were recruited in the spring of 2011 to complete either a Web-based or paper survey questionnaire. This population was chosen to be representative of personnel needed during a pandemic to support the organization and operation of a major medical center. All study procedures had Institutional Review Board approval (IRB-AAAF0398).

Questionnaire development

Five focus groups were convened with volunteer representatives of the target study population to provide qualitative input that informed the design of a new study questionnaire. The questionnaire specifically addressed individual and organizational barriers and facilitators to influenza vaccination. The questionnaire items addressed a new conceptual model (Fig 1)[19] of precaution adoption that considers individual-level and organizational-level factors, adapted from a model developed by DeJoy et al.[19] The 25-item questionnaire was designed at a 10th-grade reading level to facilitate rapid completion, generally requiring an average of 10 minutes to complete.

The study questionnaire addressed the following constructs: (1) demographic and health characteristics; (2) knowledge, concern, training; (3) vaccination history (outcomes measures); (4) barriers and facilitators to influenza vaccination uptake; and (5) intentions to take a hypothetical future novel pandemic influenza vaccine.

Demographic and health characteristics

Questions were included on gender; age; education; marital/partner status; children under the age of 18 years; health status, including past history of influenza illness (including pandemic influenza, if known); occupation and student status; and tenure.

Knowledge, concern, training

Questions were included on how knowledgeable the respondent thought they were with respect to protecting themselves from exposure to influenza (seasonal or pandemic) virus and how concerned they were about influenza contagion during a pandemic outbreak. They were asked how serious they thought the illness would be if they did become ill with the pandemic flu. Respondents were asked whether the medical center had a pandemic influenza emergency plan and whether they had ever received any related training or educational materials on this in the prior 24 months.

Vaccination history (outcomes measures)

Items addressed past seasonal influenza vaccination, including the seasonal 2009/2010 strain, pandemic pH1N1 2009/2010, and combination 2010/2011 vaccines.