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Major Article

Factors influencing seasonal influenza vaccination uptake among health care workers in an adult tertiary care hospital in Singapore: A cross-sectional survey

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Key Words:
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Background: This study aimed to evaluate the factors influencing seasonal influenza vaccination uptake among different health care professional groups.

Methods: A single-center, cross-sectional survey using a standardized anonymous, self-administered questionnaire to assess knowledge, attitudes, and uptake of seasonal influenza vaccination was used. Associations between respective health care groups and vaccination acceptance were then assessed.

Results: In total, 3,873 health care workers completed the questionnaire. Of these, 7% were administrative staff, 17% were allied health staff, 7% were ancillary staff, 11% were medical staff, and 58% were nursing staff. The overall vaccination rate for the Southern Hemisphere 2015 influenza season was 82%. In a multivariate logistic regression model, after controlling for gender and presence of chronic disease, associated factors for accepting influenza vaccination were age, education level of bachelor degree or higher, preference for vaccination provided by mobile teams, having 1-50 patient contacts per week, and belief in the potential severity of influenza and vaccine safety ($P < .05$). In contrast, factors negatively associated with vaccination acceptance included being a medical staff member or allied health staff member, living with family members under the age of 16, fear of adverse reactions, and disbelief in vaccination effectiveness ($P < .05$).

Conclusions: Although vaccine coverage in Singapore has been high, our findings provide guidance for the development of strategies to further improve vaccine coverage among different groups of health care workers.

Influenza is a major contributor to serious morbidity and mortality among patients, especially those in older age groups.[1,2] Preventive measures for the control of influenza include immunization of people at high risk for complications from the illness, their close contacts, and the health care workers (HCWs) who care for them. Vaccination of HCWs is one of the most important measures to prevent nosocomial influenza outbreaks among hospital patients and HCWs. In tropical countries such as Singapore, where the influenza virus circulates year round,[3] HCWs perpetually face the risk of contracting influenza and the potential to transmit the virus to patients at any time.

Increasing the influenza vaccination rate among HCWs has been shown to be effective in reducing the risk of nosocomial influenza infections in patients.[4] In Singapore, annual influenza vaccination is recommended for HCWs in public hospitals and has been made available to them free of charge. Despite these measures, vaccination uptake rates still need to be improved.[5,6] HCWs' knowledge, attitudes, and beliefs about influenza vaccination are important determinants of vaccination uptake. A previous review study indicated that HCWs were immunized against influenza mainly for personal benefit rather than for the benefit of their patients.[7] Misconceptions about the vaccine and its safety have been observed in overseas studies. More studies are needed to explore the psychosocial factors influencing HCWs' uptake of influenza vaccination, particularly in adult tertiary care hospitals, and to identify the major influencing factors that can be targeted to improve vaccination practices and behaviors.

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Studies on the uptake of influenza vaccination among various groups of HCWs have been conducted in Western countries. However, cultural differences exist between Western and Asian countries, and practices differ across different health care settings. Consequently, the knowledge, attitudes, and beliefs regarding influenza immunization among HCWs in Asian countries are not well understood. The aim of this study was to explore the knowledge, attitudes, practices, and beliefs of all categories of HCWs from an adult tertiary care hospital in Singapore to influenza vaccination and to identify factors specific to respective health care professional groups that can be targeted for increasing vaccination uptake. We hypothesized that common reasons for being vaccinated against influenza were self-protection from illness, protection of patients, influence of other staff, direction from senior management, accessibility and convenience in receiving the immunization, and the effectiveness of the influenza vaccine. Factors associated with not being immunized are different between health care professional groups and include a belief that the vaccine is not effective in preventing illness and fear of experiencing pain or adverse reactions from vaccination.

METHODS

Setting and participants

The study was conducted among health care workers at Tan Tock Seng Hospital from April to May 2016. Tan Tock Seng Hospital is a 1,600-bed, adult tertiary care hospital in Singapore with more than 8,000 workers. The study population consisted of 5 categories of HCWs: administrative (eg, managers, executives, and clerks); allied health (eg, pharmacists, dieticians, and clinical research coordinators); ancillary (eg, administrative assistants, health attendants, and technicians); medical (eg, clinicians with recognized medical degrees); and nursing (eg, assistant nurses, nurse managers, and nurse educators).

Study design and questionnaire

This single-center, cross-sectional survey used a standardized anonymous, self-administered questionnaire. The questionnaire was developed based on existing validated measures that used the Health Belief Model,[8] exploring constructs such as perceived risk of influenza and perceived benefits and barriers to vaccination. We also developed additional questions based on current literature to gather information that was not found in validated measures.

The questionnaire comprised 5 sections with a total of 18 questions. Sections 1 and 5 included 10 questions on demographics, job description, chronic medical conditions, and duration of employment in the health care profession. Section 2 included 5 questions that addressed self-reported participation in the most recent hospital influenza vaccination program for the Southern Hemisphere 2015 season, vaccination during the past 5 years, intention for future influenza vaccination, attitudes toward a mandatory influenza vaccination policy, and preferred site in the hospital to receive vaccination. Section 3 included 1 question with a list of reasons for acceptance or refusal of seasonal influenza vaccine, using a predefined list of choices and a free-text field for additional comments. Section 4 contained 2 questions. The first comprised 9 items assessing knowledge about influenza infection and perceptions about influenza vaccine safety, with responses based on a 4-point Likert scale. The second question assessed vaccine-access needs and recommendations to increase the vaccine uptake rate among staff, using a predefined list of choices and a free-text field for additional comments.

Both hard copy and online versions of the questionnaire were developed for our study. The online version was developed and hosted on the Qualtrics platform (Qualtrics, Provo, UT). The questionnaire was initially piloted with a convenience sample of 30 HCWs who were similar in their demographics and professional characteristics to the study population, and feedback on the questionnaire design was obtained. After obtaining permission from the hospital's senior management to conduct the study in our institution, an email invitation letter, which included a link to the online version of the questionnaire, was sent to all hospital staff with email access to invite them to participate in the study. The invitation letter (for both online and hard copy versions) provided information regarding the background and objective of the study. It also highlighted that participation in the study was voluntary. A reminder email was sent 3 weeks after the initial email. Additionally, the hard copy version of the questionnaire was distributed by hand to all staff working at the hospital, and completed questionnaires were collected from a designated staff member in each department after 3 days. Staff members were directed not to complete the questionnaire more than once, regardless of the modality used. Completion and submission of the questionnaire were taken as implied consent to participate in the study. The study protocol and questionnaire were reviewed and approved by the Domain Specific Review Board, National Healthcare Group, Singapore (DSRB reference number 2016/00050).

Statistical analysis

Data were entered into Microsoft Excel (JMicrosoft Inc, Redmond, WA) and coded. Consistency checks were used to ensure data accuracy. All data were analyzed using Stata 13 software (StataCorp, College Station, TX). The χ^2 test or the Fisher exact test was used to determine differences in the characteristics, knowledge, and perception between vaccinated and nonvaccinated groups. The 2 main outcome measures of interest were vaccination acceptance for the most recent influenza season and planned future influenza vaccination. For each of these, we constructed separate multivariate models, using stepwise multiple logistic regression analysis, to assess for associated independent factors. P values less than .05 were considered statistically significant.

RESULTS

The questionnaire was completed by 3,955 of 8,296 HCWs, giving an overall response rate of 48%. Of these, 82 respondents did not provide data on whether they had received vaccination for the most recent season and were excluded from further analysis. The remaining 3,873 respondents were included in our study.

A total of 504 (13%) participants completed the online questionnaire, whereas 3,369 (87%) completed the hard copy questionnaire. Table 1 summarizes the sociodemographic characteristics and job descriptions of the participants. Participants were distributed across the main health care family groups as follows: administration (7%), allied health (17%), ancillary (7%), medical (11%), and nursing (58%). This distribution was reflective of our hospital's population, as verified with the hospital's human resource department. Most were women (84%) and aged between 25 and 54 years (75%). A small proportion (5%) reported a history of chronic disease. Most (63%) had attained an education level of bachelor's degree or higher. At least 26% and 23% of participants reported living with family members under the age of 16 or over the age of 65, respectively. Fifty-four percent of participants had worked for more than 5 years in the health care profession. Ninety-two percent of participants reported regular contact with patients. Of these, 45% had more than 50 patient contacts per week.

A total of 3,191 (82.4%) participants reported receiving the influenza vaccination during the most recent hospital influenza vaccination program. The highest vaccination rate (85%) was observed in the nursing family group (Fig 1). Ninety-two percent (n = 3,576) of

Table 1
Characteristics of study participants (n = 3,873)

Characteristics	Number	Percentage
Age, y, mean ± standard deviation (range) (n = 3,762)	33.4 ± 9.7 (18-74)	
Sex		
Female	3,245	84%
Male	577	15%
Not available	51	1%
Education level		
Up to "O" level	313	8.1%
Up to "A" level	1,052	27.2%
Bachelor's degree	2,075	53.6%
Master's degree	337	8.7%
Doctoral degree	21	0.5%
Others	19	0.5%
Not available	56	1.4%
Any chronic disease		
No	3,490	90.1%
Yes	198	5.1%
Not available	185	4.8%
Family members staying together		
Age <16 y (n = 3,790)	1,005	26.5%
Age >65 y (n = 3,790)	868	22.9%
With chronic disease (n = 3,785)	542	14.3%
Years of service in health care		
≤5 y	1,779	45.9%
6-10 y	1,102	28.5%
11-20 y	660	17.0%
>20 y	329	8.5%
>50 y	1	0.0%
Not available	3	0.1%
Number of patient contacts per week		
0	293	7.6%
1-10	343	8.9%
11-20	492	12.7%
21-30	313	8.1%
31-40	391	10.1%
41-50	433	11.2%
>50	1,586	41.0%
Not available	22	0.6%
Health care family group		
Administration	288	7.4%
Allied health	654	16.9%
Ancillary	267	6.9%
Medical	411	10.6%
Nursing	2,253	58.2%

participants had received at least 1 influenza vaccine in the past 5 years. The number of vaccinations in the past 5 years was as follows: 2,496 (70%) had 1 vaccination, 995 (28%) had 2 vaccinations, and 85 (2%) had 3 or more vaccinations. In total, 3,082 (80%) participants stated their intention to receive the influenza vaccination in the coming year. Reasons cited for getting the vaccination by those who had received the vaccine were as follows: it was free of charge (59%), protection for family members (57%), ease of access at the workplace (48%), protection for patients (47%), belief in the vaccine's effectiveness in preventing influenza (47%), belief that influenza is a serious illness (45%), to fulfill their professional obligation (36%), to avoid missing work (30%), and because of peer pressure (19%).

No significant differences were observed between vaccinated (n = 3,191) and nonvaccinated (n = 682) participants in terms of sex, having a chronic disease, education level, and household family members aged below 16 years or 65 years or older. Vaccinated participants were significantly more likely to be older (odds ratio [OR], 1.02; 95% confidence interval [CI], 1.01-1.03), be working as nursing staff (60% vs 49%; OR 1.54; 95% CI, 1.30-1.81), have worked for a longer period of time in the health care profession (55% vs 48%; OR, 1.32; 95% CI, 1.12-1.55), have 1-50 patient contacts per week (53% vs 44%; OR, 1.40; 95% CI, 1.18-1.65), and prefer to receive vaccination from a mobile team (73% vs 62%; OR, 1.65; 95% CI, 1.39-1.97) . In addition, HCWs who had received the influenza vaccine for the Southern Hemisphere 2015 season were more likely to report intent to receive future vaccination (86% vs 54%; OR, 5.12; 95% CI, 4.28-6.14). Vaccinated HCWs were also more likely to agree to mandatory vaccination for health care staff in the institution (77% vs 66%; OR, 1.69; 95% CI, 1.41-2.02). Conversely, nonvaccinated HCWs were significantly more likely to be from the allied health group (OR, 0.63; 95% CI, 0.51-0.77), have no patient contact (OR, 0.63; 95% CI, 0.48-0.84) or more than 50 patient contacts per week (OR, 0.82; 95% CI, 0.70-0.97), and prefer to receive vaccination at the Occupational Health Clinic (OR, 0.74; 95% CI, 0.63-0.88). Univariate analysis revealed that participants who had knowledge of the need for yearly vaccination (OR, 1.42; 95% CI, 1.15-1.75) and believed that an influenza infection might lead to serious complications (OR, 1.50; 95% CI, 1.22-1.85) were significantly more likely to receive the influenza vaccination. Participants who believed in the vaccine's effectiveness in preventing influenza (OR, 1.96; 95% CI, 1.60-2.38) and the safety of the vaccine (OR, 2.23; 95% CI,

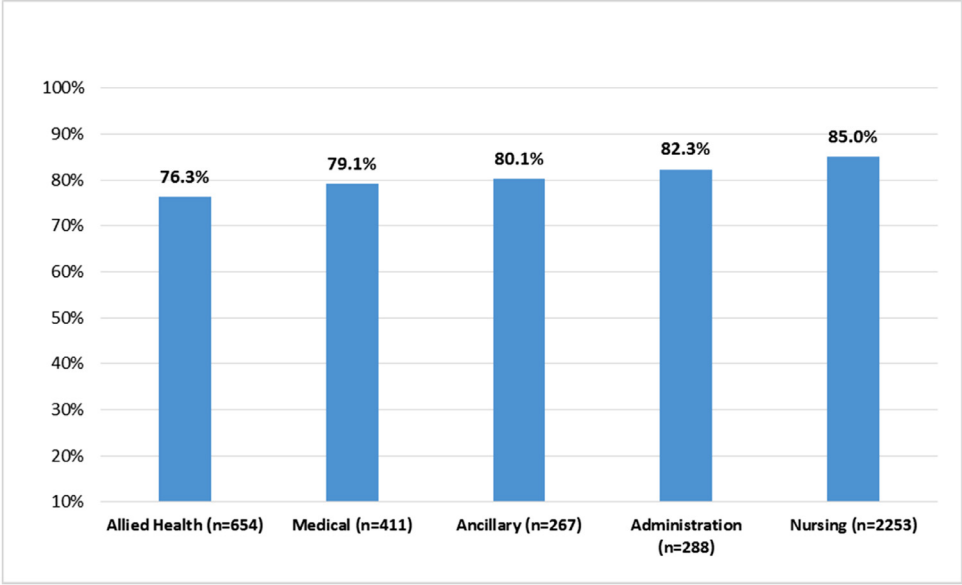

Fig 1. Reported vaccination rates by health care family groups (n = 3,873).

Table 2
Multivariate analysis of factors associated with influenza vaccination acceptance among study participants

Category	Adjusted odds ratio (95% confidence interval)	*P* value
Demographic		
Age, y	1.04 (1.02-1.05)	<.001
Male sex	1.04 (0.78-1.40)	.768
Having chronic disease	1.15 (0.71-1.87)	.568
Health care family group		
Nursing	Ref	Ref
Administration	0.96 (0.64-1.46)	.858
Allied health	0.58 (0.45-0.76)	<.001
Ancillary	0.89 (0.60-1.30)	.544
Medical	0.36 (0.26-0.51)	<.001
Education level		
Bachelor's degree or higher	1.25 (1.02-1.54)	.035
Family members staying together		
Age <16 y	0.69 (0.56-0.86)	.001
Age >65 y	1.01 (0.80-1.27)	.965
With chronic disease	1.16 (0.88-1.54)	.296
Years of service in health care		
>5	0.99 (0.78-1.25)	.934
Number of patient contacts per week		
0	Ref	Ref
1-50	1.61 (1.07-2.41)	.021
>50	1.30 (0.88-1.93)	.186
Preferred place for vaccination in the hospital		
Occupational Health Clinic	1.25 (0.86-1.84)	.242
Mobile team	2.04 (1.38-3.01)	<.001
Knowledge about influenza and its vaccination		
Influenza is a potentially serious disease	1.31 (1.12-1.54)	.001
Vaccine can cause flu	1.06 (0.92-1.22)	.435
Side effects after vaccination are common	0.75 (0.63-0.88)	<.001
Side effects after vaccination are not severe	1.13 (0.93-1.38)	.226
Vaccine is effective in preventing influenza	0.98 (0.80-1.21)	.863
Influenza vaccine is safe	1.46 (1.14-1.87)	.003
Need to get vaccine yearly	0.97 (0.81-1.17)	.776
Vaccine is not effective in preventing flu	0.78 (0.65-0.94)	.010
Vaccine is more dangerous than virus	0.98 (0.81-1.18)	.848

1.73-2.88) were more likely to have received vaccination during the previous influenza seasons.

In a multivariate logistic regression model examining factors associated with influenza vaccination acceptance (Table 2), after adjustment for potential confounders such as gender and presence of chronic disease, significant factors were age (adjusted odds ratio [AOR], 1.04; 95% CI, 1.02-1.05), education level of bachelor's degree or higher (AOR, 1.25; 95% CI, 1.02-1.54), preference for vaccination provided by mobile teams (AOR, 2.04; 95% CI, 1.38-3.01), having 1-50 patient contacts per week (compared with no patient contacts) (AOR, 1.61; 95% CI, 1.07-2.41), and belief in the potential severity of influenza (AOR, 1.31; 95% CI, 1.12-1.54) and vaccine safety (AOR, 1.46; 95% CI, 1.14-1.87). Conversely, factors negatively associated with vaccination acceptance included being a medical staff member (AOR, 0.36; 95% CI, 0.26-0.51) or allied health staff member (AOR, 0.58; 95% CI, 0.45-0.76) (compared with being a nursing staff member), living with family members under the age of 16 (AOR, 0.69; 95% CI, 0.56-0.86), fear of adverse reactions (AOR, 0.75; 95% CI, 0.63-0.88), and disbelief in vaccination effectiveness (AOR, 0.78; 95% CI, 0.65-0.94).

We further investigated the characteristics of the 682 participants —administration (n = 51), allied health (n = 155), ancillary (n = 53), medical (n = 86), and nursing (n = 337)—who had not been vaccinated during the most recent program. Of these participants, about 50% from each health care group still did not intend to receive the vaccine in the future. The most common barriers were fear of vaccine adverse effects (21%), forgetfulness (13%), perception of vaccine ineffectiveness (13%), and lack of time (11%). Of administrative staff (n = 51), the most common reasons were concern regarding side effects after influenza vaccination (38%) and fear of pain (29%). Of medical staff (n = 86), the most common reasons were lack of time (39%), lack of convenience (31%), and forgetfulness (30%). Furthermore, 36% of allied health staff and 27% of nursing staff stated that they declined influenza vaccination owing to the fear of adverse effects after the vaccination.

In a separate multivariate logistic regression model evaluating factors associated with planned future vaccination (Table 3), significant factors were age (AOR, 1.02; 95% CI, 1.01-1.04), preference for vaccination provided by a mobile team (AOR, 1.94; 95% CI, 1.26-2.99), contact with 1-50 patients per week (compared to no patient contact) (AOR, 1.79; 95% CI, 1.16-2.75) or more than 50 patient contacts per week (AOR, 1.62; 95% CI, 1.06-2.47), recent influenza vaccination for the Southern Hemisphere 2015 season (AOR, 4.18; 95% CI, 3.35-5.22), belief in the effectiveness of the vaccine in preventing influenza (AOR, 1.42; 95% CI, 1.15-1.75), belief in vaccine safety (AOR, 1.56; 95%

Table 3
Multivariate analysis of factors associated with planned future influenza vaccination among health care workers

Category	Adjusted odds ratio (95% confidence interval)	*P* value
Demographic		
Age, median (interquartile range) (y)	1.02 (1.01-1.04)	.005
Male sex	0.95 (0.69-1.30)	.752
Having chronic disease	1.30 (0.78-2.19)	.317
Health care family group		
Nursing	Ref	Ref
Administration	0.90 (0.59-1.39)	.638
Allied health	0.87 (0.66-1.15)	.322
Ancillary	1.37 (0.87-2.15)	.172
Medical	0.59 (0.41-0.86)	.006
Education level		
Bachelor's degree or higher	1.09 (0.87-1.35)	.468
Family members staying together		
Age <16 y	1.01 (0.80-1.28)	.907
Age >65 y	0.92 (0.72-1.18)	.533
With chronic disease	1.24 (0.91-1.68)	.169
Years of service in health care		
>5	0.83 (0.64-1.06)	.132
Number of patient contacts per week		
0	Ref	Ref
1-50	1.79 (1.16-2.75)	.009
>50	1.62 (1.06-2.47)	.027
Preferred place for vaccination in the hospital		
Occupational Health Clinic	1.20 (0.79-1.82)	.403
Mobile team	1.94 (1.26-2.99)	.003
Vaccination history		
Had vaccination for the 2015 season	4.18 (3.35-5.22)	<.001
Knowledge about influenza and its vaccination		
Influenza is a potentially serious disease	1.08 (0.81-1.28)	.407
Vaccine can cause flu	0.94 (0.81-1.10)	.438
Side effects after vaccination are common	0.73 (0.61-0.88)	.001
Side effects after vaccination are not severe	1.38 (1.10-1.71)	.004
Vaccine is effective in preventing influenza	1.42 (1.15-1.75)	.001
Influenza vaccine is safe	1.56 (1.20-2.03)	.001
Need to get vaccine yearly	1.91 (1.56-2.33)	<.001
Vaccine is not effective in preventing flu	0.37 (0.30-0.45)	<.001
Vaccine is more dangerous than virus	1.20 (0.89-1.34)	.383

CI, 1.20-2.03), understanding about adverse reactions (AOR, 1.38; 95% CI, 1.10-1.71), and having knowledge of the need to vaccinate yearly (AOR, 1.91; 95% CI, 1.56-2.33). However, factors negatively associated with future vaccination included being a medical staff member (AOR, 0.59; 95% CI, 0.41-0.86), fear of adverse reactions (AOR, 0.73; 95% CI, 0.61-0.88), and disbelief in vaccine effectiveness (AOR, 0.37; 95% CI, 0.30-0.45). Ninety-eight percent (3,787 of 3,873) of participants also provided at least 1 recommendation to increase vaccination uptake in the institution. These recommendations included to educate HCWs on influenza vaccination as a part of the onboarding program for new employees (55%), increase the number of mobile teams deployed within the hospital (52%), provide more advertising and education about vaccination (46%), provide reminders (35%), provide a reward (34%), make it compulsory (28%), and get senior leadership to be role models for vaccination (24%).

DISCUSSION

In Singapore, annual vaccination of HCWs against seasonal influenza has been recommended by the Ministry of Health.[9] However, vaccine coverage varies among health care institutions.[10] In our study, a high vaccination rate of 82% was reported by our study participants for the most recent influenza season. This was similar to the vaccination rate measured by the hospital's Occupational Health Clinic (89% for the same season; unpublished data), which implements the influenza vaccination program and maintains validated records of staff vaccination using an online database system. Nursing staff had the highest reported vaccination rates compared with those in the other groups, which is consistent with previous reports from other health care institutions.[10] Key features of our hospital staff influenza vaccination program are provision of the vaccine free of charge annually, widespread publicity about the program prior to and during the implementation period, and presence of mobile teams by our hospital's Occupational Health Clinic, which offer vaccination onsite in clinical areas within the hospital.

Our findings are consistent with those from previous studies evaluating factors positively associated with influenza vaccination. Increasing age was a predictive variable associated with increased influenza vaccination compliance.[11,12] Awareness of easy access to vaccination by a mobile team was one of the strongest predictors of vaccination acceptance; this was consistent with a previous local study among inpatient nurses in the same institution.[6] Our study also illustrated that belief in the potential severity of influenza and belief in vaccine safety were predictors for vaccination acceptance.[13-15] However, although presence of chronic disease has been associated with higher probability of receiving vaccinations,[12,16,17] we did not observe this in our setting. This observation may have been limited by the small number of participants with chronic disease. Interestingly, participants who had 1-50 patient contacts per week appeared to be the most likely to receive vaccination, compared with those with no contacts or more contacts. This might reflect a balance in perceived need for vaccination (working in the patient care setting) and having time in their work schedule to receive vaccination. Although protection for family members was stated as a more common reason for vaccination than the need to protect patients,[18-20] we did not find that having household family members aged below 16 years or 65 years and older (ie, the more vulnerable groups) was associated with vaccination uptake. In fact, our multivariate analysis demonstrated that having family members below 16 years was negatively associated with vaccination acceptance, possibly because these participants with young families had other priorities to deal with and/or believed they were not at risk for getting influenza since they were generally healthy. This suggests a gap between participants' beliefs and their real-life practices, which needs to be addressed in a practicable manner.

The main reasons for declining to receive vaccination in this study varied across different HCW family groups. In all groups, most believed that influenza was a serious illness, although ancillary and nursing staff members were less certain. All family groups believed in the effectiveness of vaccination and that it was safe. The medical group had the least doubt about side effects, whereas administrative and nursing groups had more concerns about the risks of vaccination. The allied health group had more doubt regarding vaccine-associated adverse reactions and more unawareness about its effectiveness; these have also been documented as the most common reasons for nonvaccination.[11,19] The medical group had knowledge about vaccine effectiveness but did not translate this into action, citing lack of time and inconvenience as the most common reasons for nonvaccination, as was reported in previous studies.[14,21,22] Allied health professionals had the highest rate of vaccination rejection, with a correspondingly low vaccination coverage. Further studies on allied health professionals and younger HCWs are needed to gain an in-depth understanding of their beliefs and attitudes toward influenza vaccination. In-depth interviews are needed to gain a deeper understanding of the reasons for vaccination refusal among selected subgroups within our institution.

The strongest predictive factor for future vaccination intention among participants was influenza vaccination acceptance in the previous season. Prior knowledge of vaccine effectiveness in preventing influenza and safety about vaccination were significantly related to plans to be immunized in the future. These findings have also been shown in other studies.[12,23,24] In our study, half of those who had never been vaccinated against influenza stated that they would still not plan to have the vaccine in the future. About two-thirds of administrative, nursing, and allied health staff members who declined vaccination stated that fear of adverse effects was the main reason for not getting the vaccine. Side effects and previous postvaccination adverse effects have been cited as major reasons for noncompliance.[11,25,26]

Our findings suggest specific ways in which we could refine existing interventions to improve influenza vaccination uptake. As part of program publicity, the messaging content should focus on influenza vaccine safety and effectiveness (eg, by sharing objective data from past programs) and aim to change attitudes about the perceived risks and inconvenience of vaccination. Several channels of communication can be used to engage staff, such as online materials posted on the hospital website, educational lunchtime talks, publicity during department meetings, and distribution of health education materials. The importance of influenza vaccination in providing protection, not just to HCWs but also to patients and their own families, should also be addressed. Specific attention should be given to establishing the main modes of communication by which specific groups, such as allied health staff, obtain information within the hospital.

Improving access to vaccination, especially among the busiest HCWs, is also key to target those with knowledge and favorable attitudes but who have not translated these into action. It is essential to determine the departments with the highest job demands and identify convenient means to target their staff. For example, for allied health and medical staff, who are often not confined to a particular work location, mobile teams may have to engage them through family group-centered events such as staff department meetings.

Our study demonstrated a higher vaccination coverage rate in HCWs that for the general population.[27] At present, influenza vaccination in our hospital is not mandatory. Achieving a much higher vaccination rate closer to 100% is likely only achievable by having a policy mandating influenza vaccination for all employees. Studies have shown that mandatory vaccination could increase vaccination uptake, reduce absenteeism during influenza season, and improve patient safety.[28-30] Our results showed that 74% of participants agreed with mandatory vaccination, and a high proportion suggested using

the onboarding program for new employees to facilitate this. Critical requirements to implementing this policy are strong support from the leadership of the institution and a robust communications and education platform for all staff groups to increase their acceptance level.

Our study had some limitations. Results may have been affected by information bias, since vaccination status and answers to all questions were self-reported. However, the questionnaire did not include any identifiable data, and participants were assured that all identities would be kept anonymous. As such, the findings are likely to be authentic. Selection bias might have been present since we may have selectively included HCWs with more positive attitudes about influenza vaccination in our study. However, we found that baseline characteristics of the participants, such as distribution of age, gender, and main health care family groups, were comparable with all HCWs in the hospital during the study period, minimizing any potential selection bias. Finally, this was a single-institution study, which may limit the generalizability of the results. Nonetheless, we think that our findings are applicable to other adult general hospitals, which may face similar challenges with vaccine acceptance among staff.

In conclusion, our study contemporaneously assessed the attitudes, perceptions, and practices of all categories of hospital staff working at the same institution toward influenza vaccination. Although vaccine coverage has been high, our findings provide guidance for the development of strategies to further improve vaccine coverage among HCWs. These would necessarily involve addressing the fear of side effects and perceptions about vaccine effectiveness among nursing and allied health professionals. Increasing accessibility to vaccination for medical staff through the increased deployment of mobile teams is also recommended.

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