Determinants of change in intention to receive influenza vaccination among health-care workers in Singapore

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ABSTRACT

Understanding the change in intention for influenza vaccine among health-care workers (HCWs) is important to increase influenza vaccination uptake. We aimed to investigate the psychosocial beliefs associated with a change in the intention for influenza vaccine. An anonymous cross-sectional survey was distributed to tertiary hospital HCWs in 2016. Of 3007 HCWs, 70% were compliant (vaccinated, with an intention to revaccinate), 8% were resistant (unvaccinated, without intention to vaccinate), 10% had positive change (unvaccinated, but with intention) and 12% had negative change (vaccinated, but without intention). Across HCW groups, medical staff had both the highest proportion receiving all influenza vaccinations in the last 5 years (101, 28.4%), as well as the highest proportion who had never received vaccination (41, 11.5%). With increasing age, HCWs were less likely to have a negative ($p = .02$) or positive change ($p = .06$) in intention, compared to the vaccine-resistant group. HCWs were more likely to be compliant or have a positive change in intention to receive influenza vaccine, if they perceived the vaccine as effective, safe, or had a higher frequency of influenza vaccination in the last 5 years (all with $p < .05$). HCWs who were medical staff, who believed that side effects of the vaccine were common, or had worked for 6 to 10 years (vs 5 years or less) were less likely to be compliant (all with $p < .05$). In conclusion, older HCWs were more likely to maintain the status quo in their behavior toward influenza vaccination. Influenza vaccination strategies should place emphasis on vaccine effectiveness and safety.

Introduction

Healthcare-associated influenza increases the risk of mortality and severe morbidity among hospitalized patients. Influenza vaccination among health-care workers (HCWs) reduces transmission of the disease in health-care settings, absenteeism among staff, and potentially overall health-care costs. Various strategies have been adopted to encourage HCWs to consistently receive influenza vaccination. These include mandatory influenza vaccination implemented in certain hospitals in the United States. Other countries without such policies, such as Singapore and Australia, promote influenza vaccination uptake through annual vaccination campaigns.

Predictors of influenza vaccine uptake among HCWs are well-documented and include personal psychosocial beliefs, accessibility and availability of vaccines, and self-efficacy, which can be categorized under various constructs of the Health Belief Model. The important attitudes and beliefs were motivation to protect themselves and their family, perceived norms to receive influenza vaccine, belief in vaccine effectiveness and safety, heightened perceived susceptibility to influenza, and perceived influenza as a severe illness. Studies have also evaluated vaccination behavior from the dimension of vaccine continuity and adherence to influenza vaccination. The predictors, such as belief that vaccination is safe and effective, and belief that an influenza infection might lead to serious illness, were similar to that of vaccine uptake. Human behavior is complex. Decisions on influenza vaccination include an evaluation of cost and benefits, and HCWs’ intention for influenza vaccination could also change over time. The decision depend on the context, setting, and their personal experience. In Spain, 30% of participants who had received influenza vaccine previously were not revaccinated against influenza, while 5% of HCWs who were never vaccinated, received the influenza vaccine. A study also showed among those who had past influenza vaccination, reluctance to attempt new behavior, also known as “status quo” bias, affected their decision for future vaccination. Nevertheless, few studies have explored the predictors for change in vaccination intention. A study in the United Kingdom showed participants who were in the “never vaccinated” group had the lowest knowledge and risk perception scores compared to the “newly vaccinated”, “continuously vaccinated” and “used to be vaccinated” groups. The authors did not explore differences in psychosocial factors between the “newly vaccinated” and “never vaccinated” groups. These predictors help in understanding the factors initiating change among those who have not received influenza vaccination. Sociocognitive predictors for influenza vaccine intention were reported to be different between health-care workers in Belgian, Dutch and German hospitals.
determinants for change in intention to receive influenza vaccine may differ in the Asian context from those in Western countries. We have previously reported factors associated with vaccine uptake but the correlates for change in vaccination practice were not examined. Therefore, in this study, we aimed to identify psychosocial factors associated with positive change and compliance in influenza vaccination intention among HCWs in a large Asian tertiary care hospital.

Materials and methods

Study design and setting

We conducted a single-center, cross-sectional study at Tan Tock Seng Hospital (TTSH), Singapore, from April to May 2016 during the annual seasonal influenza vaccination campaign. TTSH is a 1,600 bed acute care tertiary hospital with more than 8,000 workers. The hospital has all medical and surgical specialties and subspecialties except for Pediatric and Obstetrics and Gynecology. In this hospital, annual influenza vaccination is offered to all employees free of charge, and the vaccination promotion campaign is performed through e-mails, posters, word of mouth, and mobile vaccination teams. During the campaign, HCWs were encouraged to receive influenza vaccination during work events, but no personal reminders for influenza vaccination were given.

Study questionnaire

The study used a standardized anonymous, self-administered questionnaire developed based on constructs from the Health Belief Model, including perceived benefits and barriers to influenza vaccination, and perceived susceptibility and severity of influenza illness. It consisted of five sections with a total of 18 questions. This has been detailed in a previous publication. Section one and five collected information on demographics (age and gender), occupation, presence of chronic diseases and duration of employment in the healthcare sector. Section two enquired on the frequency of influenza vaccination for the last 5 years, status of influenza vaccination in 2015 and intention for influenza vaccination in 2016. Section three asked for reasons for accepting or refusing the influenza vaccine, using a pre-defined list of reasons for participants to choose from and a free-text field for additional comments. In section four, we assessed participants’ beliefs and attitudes on influenza and influenza vaccination, based on how strongly they agreed or disagreed with provided statements on a 4-point Likert scale. There were a total of nine statements covering the perceived risks and benefits/effectiveness of the influenza vaccine, and perceived susceptibility and severity of influenza. We also asked for recommendations to increase influenza vaccine uptake from participants with a pre-defined list and a free-text field. The questionnaire was piloted on 30 HCWs with demographics and occupational distribution similar to the study population.

Both online and hard copy versions of the study questionnaire were used. The online version was hosted on the Qualtrics platform (Qualtrics, Provo, UT) and the link to the questionnaire was sent to all hospital staff with e-mail access, after obtaining permission from the senior management of the hospital. The e-mail also highlighted that participation was voluntary and stated the objective and background of the study. Another reminder e-mail was sent out 3 weeks later. The hard copy version was distributed by hand to all staff working at the hospital, and completed questionnaires were collected from a designated staff in each working area after 3 days. Staff members were reminded not to complete the questionnaire more than once in either modality.

By completing and returning the questionnaire, participants were taken to have given implied consent to be enrolled in the study. Ethics approval for the study was obtained from the National Healthcare Group Domain Specific Review Board (DSRB reference number 2016/00050).

Statistical analysis

A descriptive analysis for the cohort was performed. The responses for beliefs on influenza and influenza vaccination were converted into dichotomous variables, where the responses “strongly disagree” and “disagree”, as well as “strongly agree” and “agree”, were each combined into a single group for analysis. Differences in demographics were compared using the Chi-square test for categorical variables and the analysis of variance test for continuous variables. All statistical analysis was performed using Stata version 13 (Stata Corp., College Station, TX).

Participants were also further classified into four groups based on their vaccination status in the most recent 2015 Southern Hemisphere season and their intention for future vaccination. The four groups were defined as follows: “resistant” (did not receive influenza vaccine in the most recent season and did not intend to receive in future), “compliant” (received vaccine recently and intended to receive in future), “negative change” (received the vaccine recently but did not intend to receive in future), and “positive change” (did not receive the most recent vaccine, but intended to receive in future). The primary outcomes of interest were differences in demographics and beliefs across these four groups.

We used multinomial logistic regression to assess for factors independently associated with differing vaccination status and intentions to receive influenza vaccination, using the resistant group as the reference group. Statistical significance was defined as a p-value of <0.05.

Results

The questionnaire was completed by 3,955 of 8,296 HCWs, giving a response rate of 48%. Of these, 948 respondents did not provide data on their demographics, their beliefs in influenza vaccination or the plan to be immunized in the future. The remaining 3,007 participants were included in this study. Of these, 2,504 (83%) completed the online questionnaire and 503 (17%) completed the hard copy questionnaire. Compared to participants completing the hard copy questionnaire, those
Table 1. Characteristics of study participants, n (%) unless stated otherwise.

| Characteristics                          | Resistant (n = 248) | Negative Change (n = 359) | Positive Change (n = 313) | Consistent (n = 2087) | Total (n = 3007) | P-value |
|------------------------------------------|---------------------|---------------------------|---------------------------|-----------------------|------------------|---------|
| Age, mean (SD) in years                  | 32.7 (8.7)          | 32.0 (8.4)                | 30 (7.2)                  | 33.8 (10)             | 33.1 (9.5)       | <0.001  |
| Gender                                   |                     |                           |                           |                       |                  | 0.918   |
| Female                                   | 205 (82.7)          | 304 (84.7)                | 262 (83.7)                | 1741 (83.4)           | 2512 (83.9)      |         |
| Male                                     | 43 (17.3)           | 55 (15.3)                 | 51 (16.3)                 | 346 (16.6)            | 495 (16.5)       |         |
| Years of service                         |                     |                           |                           |                       |                  | <0.001  |
| Less than 5 years                        | 117 (47.2)          | 162 (45.1)                | 186 (59.4)                | 1001 (48)             | 1466 (48.8)      |         |
| 6 to 10 years                            | 70 (28.2)           | 118 (32.9)                | 81 (25.9)                 | 537 (25.7)            | 806 (26.8)       |         |
| 11 to 20 years                           | 42 (16.9)           | 54 (15)                   | 35 (11.2)                 | 355 (17)              | 486 (16.2)       |         |
| More than 20 years                       | 19 (7.7)            | 25 (7)                    | 11 (3.5)                  | 194 (9.3)             | 249 (8.3)        |         |
| Number of patients contact (per week)    |                     |                           |                           |                       |                  | 0.067   |
| 0 patients                               | 28 (11.3)           | 37 (10.3)                 | 29 (9.3)                  | 165 (7.9)             | 259 (8.6)        |         |
| 1–20 patients                            | 44 (17.7)           | 72 (20.1)                 | 65 (20.8)                 | 475 (22.8)            | 656 (21.8)       |         |
| 21–50 patients                           | 55 (22.2)           | 104 (29)                  | 88 (28.1)                 | 609 (29.2)            | 856 (28.5)       |         |
| More than 50 patients                    | 121 (48.8)          | 146 (40.7)                | 131 (41.9)                | 838 (40.2)            | 1236 (41.1)      |         |
| Frequency of vaccination for the last five years | 127 (51.2) | 5 (1.4)       | 88 (28.1) | 18 (0.9) | 238 (7.9) | <0.001 |
| 1                                        | 51 (20.6)           | 112 (31.2)                | 80 (25.6)                 | 364 (17.4)            | 607 (20.2)       |         |
| 2                                        | 40 (16.1)           | 111 (30.9)                | 64 (20.5)                 | 388 (18.6)            | 603 (20.1)       |         |
| 3                                        | 22 (8.9)            | 52 (14.5)                 | 43 (13.7)                 | 416 (19.9)            | 533 (17.7)       |         |
| 4                                        | 4 (1.6)             | 33 (9.2)                  | 29 (9.3)                  | 305 (14.6)            | 371 (12.3)       |         |
| 5                                        | 4 (1.6)             | 46 (12.8)                 | 9 (2.9)                   | 596 (28.6)            | 695 (21.8)       |         |
| Occupational groups                      |                     |                           |                           |                       |                  | 0.002   |
| Administration                           | 18 (7.3)            | 34 (9.5)                  | 24 (7.7)                  | 162 (7.8)             | 238 (7.9)        |         |
| Allied Health                            | 60 (24.2)           | 78 (21.7)                 | 71 (22.7)                 | 352 (16.9)            | 561 (18.7)       |         |
| Ancillary                                | 18 (7.3)            | 16 (4.5)                  | 28 (9)                    | 176 (8.4)             | 238 (7.9)        |         |
| Medical                                  | 38 (15.3)           | 35 (9.8)                  | 42 (13.4)                 | 241 (11.6)            | 356 (11.8)       |         |
| Nursing                                  | 114 (46)            | 196 (54.6)                | 148 (47.3)                | 1156 (55.4)           | 1614 (53.7)      |         |
who completed the online version were older (37 vs 32 years, \( p < .001 \)), and more likely to be male (25% vs 15%, \( p < .001 \)), have worked for over 20 years (15% vs 7%, \( p < .001 \)), have no patient contact (28% vs 5%, \( p < .001 \)) and have taken influenza vaccine annually for the last 5 years (28% vs 21%, \( p < .001 \)).

Of the 3,007 participants, 2,446 (81%) reported receiving influenza vaccination during the most recent hospital vaccination programme, and 2,404 (80%) stated intention to receive influenza vaccination in the following season. Based on our group definitions, 2,087 (70%) participants formed the compliant group, 359 (12%) formed the negative change group, 313 (10%) formed the positive change group, and the remaining 248 (8%) formed the resistant group.

Table 1 summarizes the socio-demographic characteristics of participants. The mean age was 33 years (SD 9.5) and majority (84%) was female. More than half of the participants (51%) had worked for more than 5 years in the healthcare profession. Nearly 80% of participants reported more than 20 patient contacts per week. This distribution of main occupational groups was reflective of our hospital’s population, as verified with the hospital’s human resource department. Significant differences between the different vaccine intention groups were observed for age, years of service, frequency of vaccination for the last 5 years and the occupational groups.

Majority of the participants perceived that influenza was a serious disease (84%), influenza vaccine was effective (82%) and safe (91%) but the side effects of influenza vaccine were common (72%). About one-third of participants (36%) thought that influenza vaccine could cause influenza, and 9% suggested that the vaccine was more dangerous than the influenza virus itself.

### Table 2. Multinominal logistic regression of factors associated with the intention for influenza vaccination.

| Variables                                      | Negative change (n = 359) | Positive change (n = 313) | Compliant (n = 2087) |
|------------------------------------------------|---------------------------|---------------------------|----------------------|
|                                                 | AOR (95% CI)              | AOR (95% CI)              | AOR (95% CI)         |
| Knowledge, attitudes and beliefs                |                           |                           |                      |
| Side effects after vaccination are common       | 0.78 (0.50–1.22)          | 0.81 (0.51–1.27)          | 0.60 (0.40–0.90)     |
| Side effects after vaccination are not severe   | 0.91 (0.57–1.47)          | 1.30 (0.76–2.25)          | 1.29 (0.82–2.03)     |
| Influenza is a potentially serious disease      | 1.14 (0.74–1.76)          | 0.90 (0.57–1.43)          | 1.42 (0.94–2.13)     |
| Influenza vaccine is safe                       | 1.19 (0.72–1.97)          | 2.52 (1.26–5.05)          | 2.71 (1.63–4.52)     |
| Need to get vaccine yearly                      | 0.74 (0.50–1.12)          | 1.96 (1.21–3.16)          | 1.68 (1.13–2.46)     |
| Vaccine can cause flu                           | 0.99 (0.67–1.54)          | 0.99 (0.67–1.47)          | 0.89 (0.63–1.26)     |
| Vaccine is effective in preventing influenza    | 1.24 (0.79–1.94)          | 2.28 (1.34–3.89)          | 2.27 (1.48–3.48)     |
| Vaccine is not effective in preventing flu      | 1.25 (0.81–1.94)          | 0.27 (0.16–0.46)          | 0.35 (0.23–0.53)     |
| Vaccine is more dangerous than virus            | 0.72 (0.42–1.23)          | 0.90 (0.48–1.60)          | 0.86 (0.52–1.48)     |
| Age (years)                                     |                           |                           |                      |
| Male gender (vs female)                         | 1.14 (0.68–1.89)          | 1.12 (0.67–1.89)          | 1.29 (0.81–2.04)     |
| Presence of chronic diseases                    | 1.60 (0.61–4.21)          | 1.59 (0.56–4.50)          | 1.77 (0.71–4.41)     |
| Years of service (vs 5 years or less)           |                           |                           |                      |
| 6 to 10 years                                   | 0.84 (0.53–1.34)          | 0.87 (0.54–1.41)          | 0.43 (0.28–0.66)     |
| 11 to 20 years                                  | 1.03 (0.52–2.06)          | 1.05 (0.51–2.17)          | 0.58 (0.31–1.09)     |
| More than 20 years                              | 1.72 (0.57–5.20)          | 1.11 (0.33–3.71)          | 0.61 (0.22–1.67)     |
| Frequency of vaccination for the last 5 years   | 2.83 (2.38–3.38)          | 1.87 (1.56–2.25)          | 4.13 (3.49–4.89)     |
| Number of patient contacts per week (vs 0 patients) |                       |                           |                      |
| 1 to 20                                        | 1.30 (0.62–2.73)          | 1.46 (0.67–3.18)          | 2.05 (1.03–4.06)     |
| 21 to 50                                       | 1.61 (0.78–3.33)          | 1.91 (0.89–4.10)          | 2.35 (1.19–4.62)     |
| More than 50                                    | 1.07 (0.55–2.08)          | 1.21 (0.60–2.43)          | 1.53 (0.83–2.85)     |
| Healthcare groups (vs Nursing)                 |                           |                           |                      |
| Administration                                  | 1.18 (0.56–2.49)          | 1.14 (0.52–2.51)          | 0.91 (0.46–1.82)     |
| Allied Health                                   | 0.79 (0.49–1.28)          | 1.27 (0.77–2.09)          | 0.72 (0.46–1.13)     |
| Ancillary                                       | 0.55 (0.25–1.21)          | 1.08 (0.53–2.21)          | 0.93 (0.49–1.75)     |
| Medical                                         | 0.40 (0.21–0.75)          | 0.65 (0.36–1.20)          | 0.28 (0.16–0.49)     |

Bold numbers indicate \( p \)-value < 0.05

### Primary outcomes

On univariate analysis, significant differences were observed between the compliant and resistant groups in all the vaccine beliefs and knowledge-related questions (\( p < .05 \)). On multivariable analysis (Table 2), the compliant group and positive change groups were similar in their psychosocial beliefs on influenza vaccine. Compared to the resistant group, both were more likely to perceive that vaccination was safe (\( p < .009 \) and \( p < .001 \)), effective (\( p < .002 \) and \( p < .001 \)), and should be taken yearly (\( p = .006 \) and \( p = .011 \)). They had also more frequently received vaccination against influenza for the last 5 years (both \( p < .001 \)).

In addition, the compliant group was more likely to believe that side effects of influenza vaccination were uncommon (\( p = .013 \)), and have contact with 1–20 or 21–50 patients per week (vs no patient contact, \( p = .04 \) and \( p = .013 \), respectively). The compliant group was less likely to be from the medical health-care group (\( p < .001 \)) or have 6 to 10 years of work experience (vs 5 years or less, \( p < .001 \)).

Compared to the resistant group, both the positive change and negative change groups were less likely to be of older age (\( p = .02 \) and \( p = .056 \), respectively). The negative change group was also less likely to be from the medical health-care group (vs nursing, \( p < .001 \)).
Discussion

This study showed a high influenza vaccination rate among HCWs and a high percentage with the intention to adhere to future hospital recommendations for annual vaccination (both around 80%). Several modifiable and non-modifiable factors for positive change and the intention to comply with the influenza vaccination were identified in this study.

The results also suggested that the “status quo” effect more strongly affected older HCWs. With increasing age, those who had been compliant or resistant remained as such. Younger HCWs might not have developed firm beliefs on influenza vaccine yet, and hence were more receptive to new information and health messages. However, older HCWs’ beliefs would have been shaped by their experience and past practices, and they might not have been as likely to change their health behavior. Given vaccine uptake is positively associated with receiving past influenza vaccine, nurturing the habit to receive the vaccine annually is important to increase influenza vaccine coverage.25 Our results suggest that this habit should be inculcated at a younger age, ideally starting from the time when HCWs first join the health-care profession. For the older workers in the resistant group, a multi-pronged approach addressing their concerns might be needed to influence their beliefs and behavior.

Participants who had worked for 6 to 10 years were less likely to be compliant, compared to those who worked less than 5 years. This is contrary to a systematic review where one of the barriers to vaccination was fewer years of working experience.26 It is possible that the influenza vaccination campaign in the hospital had a differential effect on the HCWs’ perception and intention for influenza vaccine, depending on their preexisting beliefs.27 Furthermore, message fatigue could result in negative attitudes toward the recommended messages.28,29 Recall of public health messages is inversely associated with number of messages received per week.30 Those who have worked longer were also more susceptible to message fatigue as they were more likely to be in the senior position, have added responsibilities and high workload. Lastly, the beneficial effects of influenza vaccine might not be salient to HCWs who had been working for many years, as other pathogens may cause similar illness and prevention of influenza transmission is not easily observed in one single ward/work location.31

Our results add to the current knowledge that, in the local context, perceived vaccine effectiveness and safety are not only associated with vaccine uptake but are also important predictors for influenza vaccine intention change, independent of the frequency of past influenza vaccination. The observation that compliant and positive change groups were more likely to believe that influenza vaccine was effective and safe is consistent with international and local studies which associated influenza vaccine uptake and adherence with constructs from the Health Belief Model and Theory of Planned Behavior, which include effectiveness and safety beliefs.8,15,18,32–35 HCWs’ perception on vaccine effectiveness and safety are subjected to biases from past experiences or anecdotes.7,34 HCWs, especially those in the resistant group, might attribute illnesses caused by other respiratory viruses and unpleasant symptoms to the influenza vaccine, even long after the vaccination date because the event was easy to recall.34 As a result, the vaccine may be deemed ineffective. The act of injecting foreign material into the body increases the misconception.34

Mandatory influenza vaccination, where influenza vaccination is one of the condition for employment or severe restriction for unvaccinated HCWs, is the most effective measure to increase vaccination coverage among health-care workers.4,36 Other effective strategies include declination form, mandatory policy without consequences, increased access and heightened awareness.36 Innovative measures to deliver influenza vaccine messages could also prevent message fatigue and ignorance among existing HCWs.28 The impact of each influenza campaign strategies (e.g. mode, accessibility, and frequency) on message fatigue will need to be explored to ensure the effectiveness of the influenza campaign and efficient use of resources.

Interventions will also need to improve the perceptions of HCWs on influenza vaccine effectiveness and safety, the two most important psychosocial determinants in this hospital context. However, providing figures on vaccine effectiveness may not be sufficient as the effectiveness of the influenza vaccine fluctuates annually.11,32,34 Some HCWs also cited a lack of evidence showing that influenza rates among patients could be reduced by vaccinating HCWs.4 Based on behavioral theories, information about the influenza vaccine including the safety, effectiveness, and benefits that are disseminated by peers and reputable physicians may increase confidence in the vaccine.32,37 Hospitals could leverage on individual, social, environmental and policy determinants to increase the vaccine adherence, especially among the older workers who are resistant.

Our study had some limitations. Firstly, the modest participation rate might pose potential selection bias. We incorporated two methods of data collection to ensure that the participants were representative of the hospital employees. However, although there were differences in the participants’ characteristics between the two methods of survey distribution, the overall baseline characteristics of participants and the distribution of main healthcare family groups were comparable with all HCWs in the hospital. The self-reported influenza vaccine uptake in this study was also similar to the vaccination rate measured by the hospital’s Occupational Health Clinic, which systematically maintains vaccination records for all hospital staff. Secondly, the study was a self-administered questionnaire with the outcome measures involving self-reported current vaccination status and intention for future vaccination, but not based on the actual vaccination records of staff. We also did not assess if the methods of data collection, either online or offline, affected the response of the participants. However, as the survey was self-administered and anonymous, and staff had voluntarily participated in the study, we believe that the responses were likely to be authentic with minimal social desirability bias. Thirdly, we did not measure the degree of participants’ exposure to the influenza campaign in the hospital or the media, and participants were not asked if they received a personal recommendation to receive the vaccine. This could be explored in future studies.
to evaluate the effectiveness of the influenza vaccine campaign.

In conclusion, our study provided insights into the determinants for change in intention to receive seasonal influenza vaccination among HCWs in an Asian context. There were similarities and differences compared to known predictors of vaccine uptake and adherence, which could be context-specific. Older HCWs were more likely to maintain the status quo in behavior toward influenza vaccination. Medical HCWs were also divided into vaccine behavior with strong opposers and supporters of influenza vaccine. Perceived vaccine effectiveness and vaccine safety were important correlates of vaccine compliance and positive change in the intention for influenza vaccine. These findings should be used to guide future vaccination promotion campaigns, to increase HCWs’ adherence to annual influenza vaccination.

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