

Effectiveness of Influenza Vaccination on Work Absenteeism among Healthcare Workers in Tertiary Hospitals in Perak, Malaysia

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Abstract

Objective: Influenza is a major health problem worldwide. Healthcare workers are at increased risk of contracting influenza and spread the disease to their patients and family members. Influenza vaccination is an important public health preventive action to stop the transmission of the disease. However, the uptake remains low due to doubt in the effectiveness of the influenza vaccine. Therefore, the aim of this study is to determine the effectiveness of influenza vaccination in reducing influenza-related work absenteeism among HCWs in Malaysia.

Study Design: This is a cross-sectional study.

Methods: The study was conducted at two specialist hospitals in Perak, involved 774 nurses and assistant medical officers who were selected using multistage random sampling. It used a self-administered questionnaire that contained a section on sociodemographic characteristics, and numbers of influenza-related sick leaves in the year of 2017. The influenza vaccination uptake was based on immunization record for the period between 1st November 2016 and 31st December 2016.

Results: The result shows the non-vaccinated HCWs reported more often influenza-related sick leave (18.1%, mean 0.39 ±1.03) than by vaccinated HCWs (16.2%, mean 0.27 ± 0.75), although the difference was found to not be statistically significant ($p=0.388$). However, notably, the total number of workdays lost due to influenza among non-vaccinated HCWs was 1.44 times higher than that among the vaccinated group in the studied hospitals.

Conclusions: These findings could motivate policy makers to strengthen the implementation of an influenza vaccination programme among HCWs and to encourage HCWs to be immunized against influenza.

Keywords: absenteeism, effectiveness, healthcare worker, hospital, influenza, vaccination.

Introduction

Influenza is a major health problem worldwide. The disease causes a spectrum of respiratory tract infections ranging from mild upper respiratory tract infection to severe pneumonia (1). The term 'healthcare worker' is an umbrella term that covers a variety of job categories such as, for example, doctors, nurses, assistant medical officers, and allied health and support service workers. All of these HCWs are at increased risk of contracting influenza. Lietz et al undertook a systematic review of 26 studies and a meta-analysis of 15 studies to assess the occupational risk of acquiring influenza A

(H1N1) among HCWs during the 2009 pandemic globally (2). The researchers found that the pooled prevalence rate of influenza for HCWs was 6.3% and the risk of acquiring an infection was twice as high as that of the control or comparison group (OR 2.08; 95% CI 1.73, 2.51).

Also, in the systematic review conducted by Kuster et al, it was reported that the pooled incidence of influenza among unvaccinated HCWs was 18.7% (95% CI 16%, 22%) per season, of which 7.5% were symptomatic (3). Their study also showed that the risk of

developing influenza among HCWs was higher than among non-HCW adults.

Healthcare workers are not only classed as high risk in terms of contracting the infection, but also in terms of their ability to spread the virus to vulnerable patients, their colleagues and their own family members. In a Canadian study conducted between 2006 and 2012, healthcare transmission was associated with 17.3% of laboratory-confirmed influenza cases among hospitalized patients (4). Indeed, HCWs have been identified as a primary source of infection in many influenza outbreaks.

In addition to its impact on morbidity and mortality, an influenza outbreak in a healthcare facility is also associated with increased work absenteeism and disrupts of healthcare services as well as a high expenditure on treatment, prophylaxis, contact-tracing and infection-control measures. Therefore, to prevent both the contraction and the transmission of the influenza infection and its associated costs, HCWs are expected to be vaccinated against the virus.

The influenza vaccine is known to be effective in reducing influenza-like illness symptoms, laboratory confirmed influenza, hospitalization and mortality among children, elderly, pregnant lady and HCWs (5). The benefits are commonly reported in temperate regions with a clear seasonal influenza (6–8). However, there is limited data on the effectiveness of the influenza vaccine among HCWs in tropical regions (5). This is an issue of particular importance as the influenza season continues throughout the year in tropical countries (Sam et al, 2018). One of the main concerns is the waning of immunity following the months of vaccination because this results in a decrease in the vaccination benefit (5). For example, Ferdinands et al. (2017) conducted a study among patients aged more than 9 years old that presented with acute respiratory illness in the US, and observed significant decreasing vaccine effectiveness with increasing time since vaccination (10). Hence, vaccine effectiveness in tropical countries such as Malaysia requires further investigation. Furthermore, Malaysia Ministry of Health has been introducing a free influenza vaccination program for HCWs. However, the uptake among HCWs remains low due to variety of reasons. Many HCWs were doubt in the effectiveness of the influenza vaccine (11). The study aimed to perform a

cross sectional study to determine the effectiveness of influenza vaccination on influenza-related work absenteeism among HCWs in Malaysia. This finding could motivate policy makers to strengthen the implementation of an influenza vaccination programme among HCWs and to encourage HCWs to be immunized against influenza.

Methodology

Study design and population

This was a cross-sectional design which was conducted in two tertiary hospitals in Perak: Hospital Raja Permaisuri Bainun (HRPB) in Ipoh and Hospital Taiping. In this study, the inclusion criteria were nurses (including sisters, registered nurses and community nurses) and assistant medical officers who had been working in HRPB and Hospital Taiping for a minimum period of 12 months. The period of employment was verified with the human resources department. Participants who were known to have an allergy to influenza vaccination were excluded from the study.

Sampling method

The sampling for this study was conducted using multistage random sampling. Out of the 15 public hospitals in Perak, two hospitals were randomly chosen: HRPB and Hospital Taiping. A list of nurses and assistant medical officers was obtained from the human resources department of each hospital. Participants were randomly selected from these lists using STATA version 14.0.

Study instrument and outcomes

The study instrument consisted of self-administered questionnaire that contained a section on sociodemographic characteristics and numbers of sick leave related to influenza in the year of 2017. The following sociodemographic information was collected from the participants: age, gender, ethnicity, education level, job category, department and monthly income. To assess the prevalence of vaccination uptake, information on vaccination status was obtained from the immunization record held by the Public Health Unit of the studied hospitals during the period between 1st November 2016 and 31st December 2016. Everyone was offered and accessible to influenza vaccine during this period. Furthermore, to assess the effectiveness

of the influenza vaccination, participants were asked about their influenza-related sick leave which was used as a proxy for vaccination effectiveness. The specific question that was posed was: “In 2017, how many days did you take sick leave due to influenza-like illness symptoms such as fever, cough, sore throat, runny nose, muscle or body aches, headache, tiredness and acute respiratory tract infection?”.

Statistical analysis

Comparison between groups was performed by using chi-square for categorical data and t-test or Mann-Whitney U-test for numerical data. One-way analysis of variance (ANOVA) was used to explore whether there was a significant difference among more than two groups. A p-value <0.05 was considered as statistical significance.

The effectiveness (%) of the influenza vaccination on the rate of absence (ROA) was calculated as follows: $100 \times (\text{ROA in non-vaccinated group} - \text{ROA in vaccinated group}) / \text{ROA in non-vaccinated group}$. ROA was calculated as: the number of sick days/number of subjects in the study (12). All analysis was performed using STATA version 14.0 (serial number 301406227318).

Ethics

Ethics approval for this study was granted by the Medical Research & Ethics Committee (NMRR-17-333-34417(IIR)) of the Malaysian Ministry of Health.

Results

According to the staff numbers at each hospital, 700 questionnaires were distributed to HRPB and 400 to Hospital Taiping. A total of 800 participants consented to participate: 412 from HRPB with response rate of 58.9% and 388 from Hospital Taiping with response rate of 97%. Out of the 800 who returned the questionnaires, 774 were completed questionnaires that were subjected to analysis. The sociodemographic characteristics of study participants according to vaccination intake are shown in Table 1. Majority of the participants were female, Malay, with tertiary education, registered nurses and with middle monthly income of RM3001–RM5000. Based on the immunization records, the prevalence of influenza vaccination among HCWs was 25.6%.

The result shows that out of the 774 participants, 136 (17.6%) reported taking influenza-related sick leave in the past 12 months in 2017.

Table 2 shows sick leave was reported significantly more often by male HCWs (mean 0.78 ± 1.75) than by female (mean 0.32 ± 0.86 , $p=0.003$). Besides, the non-vaccinated HCWs also reported higher mean sick leave (mean 0.39 ± 1.03) than by vaccinated HCWs (mean 0.27 ± 0.75) with excess of 0.12 of mean days lost was recorded in unvaccinated HCWs. However, the difference was found to not be statistically significant ($p=0.388$).

A one-way analysis of variance shows there was significant difference at the $p < 0.05$ level in the mean number of sick leave for the different job categories [$F(3,770) = 7.04$, $p = 0.001$]. Post-hoc analysis using the Duncan test shows that there was statistically significant difference in the mean number of sick leave between sister and assistant medical officer (0.81 ± 0.19 , $p < 0.001$), between community nurse and assistant medical officer (0.70 ± 0.18 , $p = 0.001$), between registered nurse and assistant medical officer (0.54 ± 0.15 , $p < 0.001$) and between registered nurse and sister (0.27 ± 0.12 , $p = 0.038$). The result also shows that there was significant difference at the $p < 0.05$ level in the mean number of sick leave for the different departments [$F(7,766) = 2.68$, $p = 0.001$]. Post hoc analysis shows statistically significant difference in the mean number of sick leave between Orthopaedic and O&G department (0.35 ± 0.13 , $p = 0.021$), between Emergency and O&G department (0.52 ± 0.17 , $p = 0.008$), between Orthopaedic and other department group (0.31 ± 0.12 , $p = 0.029$) and between Emergency and other department group (0.48 ± 1.64 , $p = 0.011$).

Table 3 shows the effectiveness of the influenza vaccination on work absenteeism. The total work days lost due to influenza was 225 days/ year among non-vaccinated HCWs and 53 days / year among the vaccinated HCWs in the studied hospitals. However, notably, the total number of workdays lost due to influenza among non-vaccinated HCWs was 1.44 times higher than that among the vaccinated group in the studied hospitals (39 days/100 subjects in the non-vaccinated group vs 27 days/100 subjects in the vaccinated group). Therefore, the vaccine effectiveness was calculated to be 30.8 %.

Table 1. Sociodemographic characteristic comparison between vaccinated and non-vaccinated HCWs (N=774)

Variable	Total	Non-vaccinated	Vaccinated	P value
	N=774	N = 576	N = 198	
	n (%)	n (%)	n (%)	
Age, mean \pm SD	34.9 \pm 7.69	34.7 \pm 7.63	35.2 \pm 7.86	0.437
Gender				
Male	63 (8.1)	48 (8.3)	15 (7.6)	0.737
Female	711 (91.9)	528 (91.7)	183(92.4)	
Ethnicity				
Malay	680 (87.9)	508 (88.2)	172 (86.9)	0.622
Non-Malay	94 (12.1)	68 (11.8)	26 (13.1)	
Education				
Secondary school	97 (12.5)	76 (13.2)	21 (10.6)	0.343
Tertiary	677 (87.5)	500 (86.8)	177 (89.4)	
Job category				
Assistant medical officer	43 (5.6)	33 (5.7)	10 (5.0)	0.932
Sister	68 (8.8)	52 (9.0)	16 (8.1)	
Community nurse	90 (11.6)	68 (11.8)	22 (11.1)	
Registered Nurse	573 (74.0)	423 (73.4)	150 (75.8)	
Department				
Medical	240 (31.0)	165 (28.6)	75 (37.9)	<0.001
Surgical	100 (12.9)	74 (12.8)	26 (13.1)	
Obstetrics & Gynaecology	163 (21.1)	152 (26.4)	11(5.6)	
Anaesthesiology	52 (6.7)	32 (5.6)	20 (10.1)	
Paediatric	78 (10.1)	49 (8.5)	29 (14.6)	
Orthopaedic	79 (10.2)	64 (11.1)	15 (7.6)	
Emergency	40 (5.2)	21 (3.6)	19 (9.6)	
Others	22 (2.8)	19 (3.3)	3 (1.5)	
Monthly income				
<RM3000	324 (41.9)	242 (42.0)	82 (41.4)	0.386
RM3001–RM5000	403 (52.1)	303 (52.6)	100 (50.5)	
>RM5001	47 (6.0)	31 (5.4)	16 (8.1)	
Taking influenza-related sick leave in the past 12 months	136 (17.6)	104 (18.1)	32 (16.2)	0.546

Table 2. Mean number of sick leaves taken by healthcare workers in 12-month period

Variables	Mean (SD)	P value
Gender		
Male	0.78 (\pm 1.75)	0.003
Female	0.32 (\pm 0.86)	
Job categories		
Assistant medical officer	0.91 (\pm 2.01)	<0.001*
Sister	0.10 (\pm 0.35)	
Community nurse	0.21 (\pm 0.68)	
Registered Nurse	0.37 (\pm 0.93)	
Department		
Medical	0.25 (\pm 0.77)	0.001*
Surgical	0.45 (\pm 0.87)	
Obstetrics & Gynaecology	0.21 (\pm 0.60)	
Anaesthesiology	0.56 (\pm 0.96)	

Paediatric	0.36 (\pm 0.94)	
Orthopaedic	0.56 (\pm 1.34)	
Emergency	0.73 (\pm 2.10)	
Others	0.25 (\pm 0.77)	
Vaccination status		
Non-vaccinated	0.39 (\pm 1.03)	0.388
Vaccinated	0.27 (\pm 0.75)	

*One-way analysis of variance

Table 3. Effectiveness of the influenza vaccination on work absenteeism

Study outcome	Non vaccinated group	Vaccinated group	Vaccine effectiveness (%)
Total work day lost in the past 12 months	225	53	-
Total work day lost (rate per 100 subjects)	39	27	30.8

Discussion

The aim of this study was to determine the effectiveness of the influenza vaccination on influenza-related work absenteeism among HCWs. This study showed an interesting result where there was an increase in absenteeism among the non-vaccinated HCWs as compared to vaccinated HCWs, although the difference was not significant. This mirrors the result of a study among HCWs in residential nursing homes (Michiels et al., 2011) and that of a study among Malaysian petrochemical workers (12).

In contrast, a Cochrane review of trials conducted in temperate and high-income countries among healthy adults reported that the number of working days lost was significantly reduced in the vaccinated group with an average reduction of less than half a day (13). The result of this study also contradicts to another study in a tropical country that was conducted among Singaporean HCWs. The result of the study in Singapore showed that there was a significant reduction in work absenteeism in HCWs who received the matched vaccine, compared with those who did not receive the vaccination (14). However, the protective effect was not significant if the match was poor. This implies that having a matched vaccine is important in monitoring vaccine effectiveness. However, in Malaysia, influenza subtyping is not routinely done. Sam et al. (2018) reported that 14.1% of the influenza A strains are still untyped, while influenza B is not routinely typed except from the relatively small numbers sent to the WHO Global Influenza Surveillance and Response System.

Thus, research on the matched vaccine is limited. Moreover, Zaffina et al conducted a retrospective observational study among HCWs in paediatric hospital in Italy also recorded significant higher average working days lost in unvaccinated HCWs in the 2016/2017 and 2017/2018 epidemic seasons (8).

The discrepancies in the results of this study and other studies could be explained by the intensity or duration of the epidemic, the strains of influenza virus, the match between the vaccine and the circulating virus and the work culture where HCWs tend to return to work earlier. Moreover, where there is low vaccination coverage among the participants, it follows that vaccination cannot have a significant impact on the trend of work absenteeism.

The current study found vaccine effectiveness at 30.8% in reducing influenza related work absenteeism among HCWs. This is in contrast with a prospective cohort study conducted in Singapore that reported a vaccine effectiveness at 55% in reducing influenza related absenteeism in HCWs, where participants were follow up for 1 year and the absenteeism was recorded based on the official documented medical leave (14). Meanwhile, a randomize control trial among Dentistry staff and students in Malaysia demonstrated an impressive 76.1% vaccine effectiveness in reducing influenza related absenteeism, where participants were follow up for 4 months and the outcome was ascertain via self-reported questionnaire (15). The discrepancies in the result of this study and other studies could be due to differences in the

study design and methods of reporting work absenteeism, all of which may impact the estimation of work absenteeism. Hence, more objective measure such as official medical leave records are required.

The current study has several limitations. First, the study was an observational cross-sectional study, hence causal relationships could not be inferred. Second, the study population consisted of only nurses and assistant medical officers from two tertiary hospitals in Perak. Thus, the results cannot be assumed to represent all HCWs in Malaysia. Third, information bias with regards to influenza-related absenteeism cannot be ruled out. This is because the information was self-reported and was not verified with secondary sources such as medical leave certificates or medical records to confirm the diagnosis of an influenza-related illness. Recall bias can be an issue where participants might not remember how many sick days, they have taken due to influenza symptoms.

Finally, we also unable to rule out information bias with regards to sickness presenteeism where HCWs, who is sick but still present for work. This sickness presenteeism may have a false positive impact on the estimation of the effectiveness of influenza vaccination.

Conclusion

The prevalence of influenza-related work absenteeism is high where this study found that 1 in 6 or 17.6 % HCWs in the studied hospitals reported influenza-related sick leave in the past 12 months in 2017. Moreover, the total influenza-related sick leave in year 2017 in the non-vaccinated HCWs was 225 days.

The benefit of influenza vaccination was seen by lower number of influenza-related sick leave in the vaccinated group (mean 0.27 ± 0.75) than by non-vaccinated HCWs (mean 0.39 ± 1.03), although the difference was not significant. To give the figure some context, the total influenza-related sick leave among non-vaccinated HCWs was 1.44 times higher than among the vaccinated group in the studied hospitals. These findings could motivate policy makers to strengthen the implementation of an influenza vaccination programme among HCWs and to encourage HCWs to be immunized against influenza.

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References

- [1]. Sam, I.C., 2015, The burden of human influenza in Malaysia. *Med J Malaysia*, 70(3), 127–30.
- [2]. Lietz, J., Westermann, C. Nienhaus, A., Schablon, A., 2016, The occupational risk of influenza A (H1N1) infection among healthcare personnel during the 2009 pandemic: A systematic review and meta-analysis of observational studies. *PLoS One*, 11(8), 1–19.
- [3]. Kuster, S.P., Shah, P.S., Coleman, B.L., Lam, P.P., Tong, A., Wormsbecker, A., et al, 2011, Incidence of influenza in healthy adults and healthcare workers: A systematic review and meta-analysis. *PLoS One*, 6(10), 1–9.
- [4]. Taylor, G., Mitchell, R., McGeer, A., Frenette, C., Suh, K.N., Wong, A., et al, 2014, Healthcare-Associated Influenza in Canadian Hospitals from 2006 to 2012. *Infect Control Hosp Epidemiol*, 35(02), 169–75. Available from: https://www.cambridge.org/core/product/identifier/S0899823X00190932/type/journal_article.
- [5]. World Health Organization, 2015, Seasonal Influenza Vaccine Use in Low- and Middle-Income Countries in the Tropics and Subtropics: A systematic review. Available from: http://apps.who.int/iris/bitstream/10665/188785/1/9789241565097_eng.pdf.
- [6]. Ferroni, E., Jefferson, T., 2011, Influenza. *BMJ*, 1–29.
- [7]. Michiels, B., Govaerts, F., Remmen, R., Vermeire, E., Coenen, S., 2011, A systematic review of the evidence on the effectiveness and risks of inactivated influenza vaccines in different target groups. *Vaccine*, 29(49), 9159–70.
- [8]. Zaffina, S., Gilardi, F., Rizzo, C., Sannino, S., Brugaletta, R., Santoro, A., et al, 2019, Seasonal influenza vaccination and absenteeism in health-care workers in two subsequent influenza seasons (2016 / 17 and 2017 / 18) in an Italian pediatric hospital. *Expert Rev Vaccines*. Taylor & Francis, 18(4), 411–8.

- [9]. Sam, I.C., Wan Noraini, Sukhvinder Singh Sandhu, Ismail Norizah, Sengol Selvanesan, Ravindran Thayan, et al, 2018, Seasonal influenza activity based on laboratory surveillance in Malaysia, 2011-2016. *J Med viro*.
- [10]. Ferdinands, J, M, Fry, A.M., Reynolds, S., Petrie, J.G., Flannery, B., Jacksonm, M.L., et al, 2017, Intraseason waning of influenza vaccine protection: Evidence from the US influenza vaccine effectiveness network, 2011-2012 through 2014-2015. *Clin Infect Dis*, 64(5), 544–50.
- [11]. Zetti Zainol Rashid, Humaira' Jasme, Ho, J.L., Mardiyah Mohd Yusof, Zatil Zahidah Mohd Sharani, Marlyn Mohamad, et al, 2015, Influenza Vaccination Uptake among Healthcare Workers at a Malaysian Teaching Hospital. *Southeast Asian J Trop Med Public Health*, 46(2), 215–25.
- [12]. Abu, H. Samad., Usul, MHBHJ., Zakaria, D., Raman, I., Tasset-Tisseau, A., Baron-Papillon, F., et al, 2006, Workplace vaccination against influenza in Malaysia: Does the employer benefit? *J Occup Health*, 48(1), 1–10.
- [13]. Jefferson, T., Rivetti, A., Demicheli, V., Ferroni, E., 2012, Vaccines for preventing influenza in healthy adults (Review). *Cochrane Database Syst Rev*, 15(8), 1–185.
- [14]. Kheok, S.W., Chong, C.Y., McCarthy, G., Lim, W.Y., Goh, K.T., Razak, L., et al, 2008, The Efficacy of Influenza Vaccination in Healthcare Workers in a Tropical Setting: A Prospective Investigator Blinded Observational Study. *Ann Acad Med Singapore*, 37, 465–9.
- [15]. Lee, S.H., Hesham Rashwan, Mohd Hasni bin Jaafar, Haizal Mohd Hussaini, Datin Ilina Isahak, 2008, Effectiveness of influenza vaccine in preventing influenza-like illness among Faculty of Dentistry staff and students in Universiti Kebangsaan Malaysia. *Health Infect. Elsevier*, 13(1), 4–9. Available from: <https://www.sciencedirect.com/science/article/pii/S1835561716302538?via%3Dihub>.