PREVALENCE AND DETERMINANTS OF INFLUENZA VACCINE ADMINISTRATION AMONG HEALTH CARE WORKERS AT PRIMARY HEALTHCARE CENTERS OF THE MINISTRY OF HEALTH IN JEDDAH 2019

Layan Arafah[1], Shaimaa Hawsawi[1], Amal Alfaifi[1], Widad Berdisi[1], Naeema Akbar[2]
[1]*Family Medicine Program, Public Health Department, Jeddah, Saudi Arabia.*
[2]*Clinical Preventive Medicine, Public Health Department, Jeddah, Saudi Arabia.*

ARTICLE INFO	ABSTRACT
Article history Received 07/01/2020 Available online 29/02/2020 **Keywords** Healthcare Workers; Influenza Vaccine; Determinants; Saudi Arabia.	Background: Influenza is a substantial threat to healthcare settings, and the annual influenza vaccine (IV) is an effective preventive measure against influenza. However, the vaccination rate among health care workers (HCWs) remains low. Objective: This study aimed at assessing vaccine coverage among HCWs at the primary health care centers of the Saudi Ministry of Health (MOH), and determine factors affecting compliance to vaccination. Methods: We conducted a cross-sectional study, and by applying a multistage clustering sample method, we randomly selected 83 male and 202 female HCWs. We used a self-administered questionnaire to collect information about IV uptake and its determinants. We performed the chi-square test to define associated factors and used binomial logistic regression analysis to determine the unconfounded predictors of IV. Results: The rate of IV among HCWs ranged from 53.3% during 2016 to 51.7% during the 2018 season. Compliances to successive vaccination over the past three years were only 30.2%; however, 66.2% of HCWs intended to receive the vaccine during the upcoming season. The main reasons for IV uptake included self-protection against influenza (60.7%) and caring about client's patients (44.8%). Single female nurses were more likely to be immunized against IV than other HCWs p<0.05. Both reading the official MOH IV guidelines and feeling of having sufficient knowledge about IV were unconfounded predictors for the vaccine. Conclusion: The overall immunization coverage was suboptimal, and the fact that reading the official MOH IV guidelines had a strong statistical association with a positive attitude towards vaccination emphasizes the role of governmental authorities in enhancing vaccine among the HCWs.

Corresponding author
Layan Arafah
Family Medicine Program,
Public Health Department,
Jeddah, Saudi Arabia.

INTRODUCTION

Seasonal influenza caused by one of two main types of human influenza viruses that spread easily between people and responsible for seasonal influenza epidemics; influenza virus A and influenza virus B [1]. Influenza A is commonly accountable for seasonal epidemics and pandemics [2]. Influenza infection results in substantial illness, hospitalizations, and deaths every year in a growing number of countries [3-6], along with a worldwide increase in morbidity and mortality, counting for around 3 million cases of illness and 250 000 - 500 000 annual deaths [3].

Seasonal influenza vaccine (IV) is a trivalent vaccine that protects against two subtypes of type A influenza viruses and one type of B influenza viruses [7]. It is a safe vaccine with rare allergic reactions in persons allergic to eggs, and probably in association with Guillain-Barré Syndrome [8]. The annual IV is an effective preventive measure against influenza, contributing to herd immunity and limiting the spread of the disease in the community. Recent studies indicate that a well-matched flu vaccine to most circulating flu viruses can reduce the risk of infection by 40% - 60% among the overall population [9].

Influenza remains a substantial threat to healthcare settings [10], and Health Care workers (HCWs) are at higher risk of acquiring the infection and transmitting the virus to patients, particularly the vulnerable populations [11,12]. They might as well lead to nosocomial outbreaks [13]. Health care workers include physicians, nurses, nursing assistants, technicians, dental personnel, pharmacists, emergency medical service personnel, laboratory personnel, and students [14]. Extensive studies have indicated that vaccination of HCWs was associated with a reduction in absenteeism from work and with a decrease in morbidity and mortality among hospitalized patients [15,16]. On the other hand, presenteeism, i.e., working while ill, poses another type of problem in health-care settings as infected workers may transmit the infection to patients [8].

Although many public health authorities including World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the Society for Healthcare Epidemiology (SHEA) recommended influenza vaccination for all HCWs [17-19], the annual vaccination rates among HCWs are universally low [18]. Believes and attitudes of HCWs towards IV vaccinations are essential for vaccination decisions, and studies showed that higher awareness and beliefs were associated with favorable attitudes toward vaccination [20].

The current study aims at assessing IV coverage among HCWs and determine factors affecting compliance to vaccination.

MATERIAL AND METHODS:

This cross-sectional study was conducted among HCWs at the primary health care centers (PHC) of Saudi Arabia (SA) Ministry of Health (MOH) at Jeddah city during 2019. It included different specialties; physicians (residents, generalists, specialists, and consultants), nurses, and medical technicians (lab technicians and radiologists). Using the multistage clustering sample method, we randomly selected 290 HCWs from 47 PHC distributed in five health sectors in Jeddah city. After obtaining ethical approval from the institutional review board of the family medicine joint Program in Jeddah, and written consent from the participants, a pre-validated self-administered questionnaire was submitted to the HCWs during their working hour's hand to hand and recollect at the same day.

The questionnaire involved information about IV receipts during the past years and future intentions to receive the vaccine. Determinants of receiving/non-receiving the vaccine included demographics, career-related characteristics, health status, and general knowledge and attitude towards the influenza vaccine. Besides, the questionnaire included questions about the availability of the vaccine and the presence of MOH guidance.

Data entry and analysis

Categorical variables were presented as frequencies and proportions, and continuous variables were presented as means and standard deviations. Initially, we obtained the prevalence of vaccination for the past three years (2016, 2017, and 2018). Secondly, we defined a competent participant (dependent variable) as any HCW who received the IV consecutively during the past three years. We performed bivariate analyses to study the association between the dependent variable and other predictors using chi-square tests. We conducted a binomial logistic regression analysis to determine the logit for receiving or not receiving the vaccine. Enter method was the model used for building up the Logistic regression model. The model included the following predictors; Age, Gender, marital status, having children below 16 years of age, having a chronic illness, job category, and the number of years of experience. The overall model was evaluated using three inferential statistical tests: the likelihood ratio, score, and Wald tests. The three tests yielded significant results p<.05, indicating that this model was more effective than the null model and that all observations are predicted to belong in the largest outcome category. The goodness-of-fit test (Hosmer–Lemeshow) yielded a $\chi 2(8)$ of 3.892 and was insignificant (p=.452), suggesting that the model was well-fitting to the data (Table 5).

The level of significance was set at p-value < 0.05, and all were two-sided. Statistical analyses were conducted using the IBM Statistical Package for the Social Sciences (SPSS), version 22.0.

RESULTS:
Demographic Characteristics
        A total of 290 HCWs completed the study questionnaire, of whom 83 (28.6%) were males, and 202 (69.7%) were females, their mean age was 34.75± 6.083, most of them (67.0%) were married, more than half of them reported that they had children under 16 years. Nurses comprised 38.3% of the sample, followed by physicians (34.5%) and medical technicians (34.5%). More than half of the HCWs (52.5%) spent less than ten years in the health facility, 45.7% spent from 10 to 29 years, and only 1.8% spent more than 30%. Concerning educational level, participants with bachelor's degrees constituted 44.8% of HCWs, and only 16.0% were less than Bachelors. Regarding health status, only 20.0% reported having a chronic medical condition (Table 1).

Prevalence of Influenza Vaccine
        The Influenza vaccination rate of HCWs ranged from 53.3% during the 2016 Influenza season to 51.7% during the 2018 season; however, those who received the vaccine repeatedly in every season during the past three years were 30.2%. However, a lower percentage (46.5%) received the vaccine during earlier seasons (before 2016), and a higher rate (66.2%) noted that they intend to receive the vaccine during the upcoming season (Table 2).
Figure 1 illustrates the overall vaccine uptake, as well as the yearly vaccine uptake during the past three years among HCWs based on their job category.

Perception and barriers for influenza vaccine
        Around 60% of HCWs had been offered official MOH IV Guidelines and believed that they have sufficient knowledge about IV. Equivalent percentage reported that they had the vaccine to protect themselves against flu attacks while caring for client patients was the cause of receiving the vaccine in 44.8 % of cases, having a child contact in 29.0% of cases, and preventing cross-infection in 27.3% of cases. The IV was received because it was an institutional requirement in 21.7% of cases, though only 15.5% have it as routine immunization. On the other hand, 16.6% of HCWs expressed that they were not concerned about the vaccine, and 12.8% thought the vaccine itself might cause influenza. While 9.7% of them trusted in and wished to challenge their natural immunity, 8.3% claimed that the vaccine was not available at the PHC, and 7.2% believed that not all strains are covered. Additionally, 5.9% claimed that they prefer to get the flu than to take the vaccine, and only a small group (<3%) had an allergy to the vaccine or prior experience of severe localized reaction (Table 3).

Source of knowledge about IV
        Figure 2 shows that 46.2% of HCWs gained their knowledge from the Ministry of Health sites, 37.6% from their colleagues, 21.4% from general web sites, and 19.7% from either WHO or CDC web sites. Lower proportions gained information from Medical journals, and TV/newspapers (16.9% and 14.5%). Continuous medical education programs accounted for 13.1%, while the contribution of the official MOH circulars was only 9.3%.

Predictors for compliance with Influenza Vaccination
        As for compliance with Influenza vaccination (i.e., receiving the vaccine for the past years), the age of HCWs was not associated with vaccination rate p>0.05, nevertheless being a female positively associated with vaccination. Although the vaccine rate was higher among the divorced/widowed group and least among the married, the difference was not significant, similarly having children below 16 years of age was not a significant predictor. Nurses were significantly superior in regular vaccination receipt during the past three years p<0.05, while neither educational level, years of experience nor number of patients seen/day were associated with compliance to the vaccine. Having any chronic medical condition was similarly not related to vaccine status (Table 4).
Table 5 shows the final regression model coefficients (e β) using the Wald chi-square statistic showed a significant association between IV uptake and three variables, namely, sex, marital status, and job category p<.05.

Table 1: Demographic and job characteristics of health care workers.

| Characteristics	Number	Percentage
Mean age ± SD = 34.75 ± 6.083 (Minimum= 22 Maximum=53)		
Age groups (n=263)		
20-29	35	13.3
30-39	181	68.8
40-49	40	15.2
≥ 50	7	2.7
Gender (n=285)		
Males	83	28.6
Females	202	69.7
Marital Status(n=285)		
Married	191	67.0
Single	84	29.5
Others	10	3.5
Have children (n=279)		
Yes	159	57.0
No	120	43.0
Job Category(n=264)		
Nurse	101	38.3
Physician	91	34.5
Medical technician	72	27.3
Work duration (n=280)		
< 10 years	147	52.5
10-29	128	45.7
≥ 30	5	1.8
Mean number of patients seen by health care workers is 57.64 (SD=13)		
Educational Level (n=281)		
Bachelor	126	44.8
diploma/master	88	31.3
Board/ fellowship/ PhD/ MD	22	7.8
less than Bachelor	45	16.0
Having chronic medical condition*		
Yes	58	20.0
No	232	80.0

*Diabetes mellites, Hypertensive blood pressure, Bronchial Asthma, Chronic Lung Disease, Chronic Heart Disease, Chronic Renal Disease, Immunodeficiency Disease

Table 2: Vaccination rates among health care workers during current, past, and future years.

Uptake of IV*	Number	%
Received IV during season 2016 (n=289)		
Yes	154	53.3
No	135	46.6
Received IV during season 2017 (n=289)		
Yes	152	52.6
No	137	47.4
Received IV during season 2018 (n=290)		
Yes	150	51.7
No	140	48.3
Received IV annually from 2016-2018 (n=289)		
Yes	87	30.2
No	201	69.8
Received IV during earlier seasons (n=284)		
Yes	132	46.5
No	152	53.3
Do you intend to receive IV next season (n=278)		
Yes	184	66.2
No	94	33.8

*IV= Influenza vaccine.
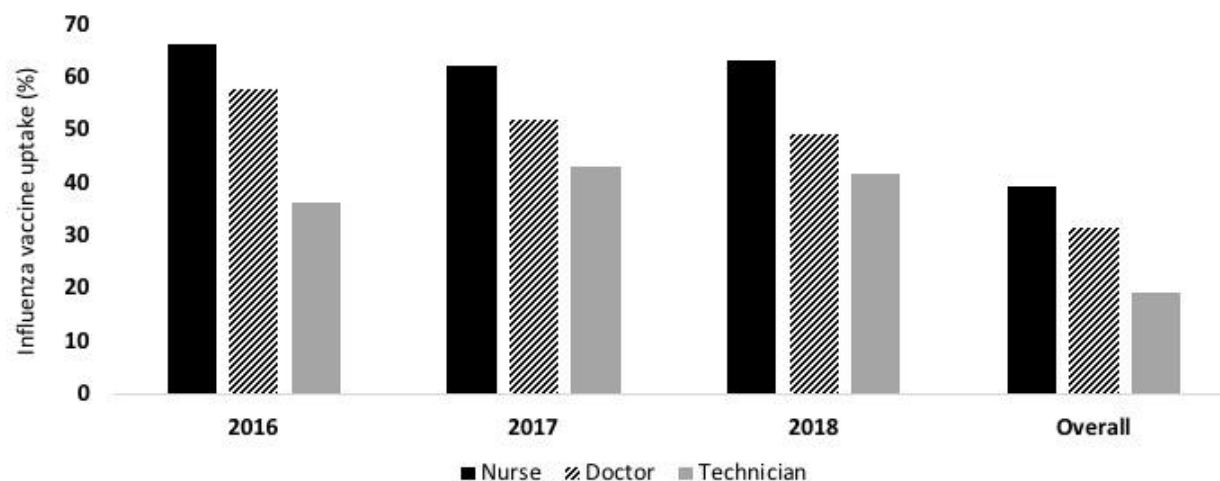
Figure 1: Distribution Of Influenza Vaccine Uptake Among Health Care Workers According To Their Job Category.

Table 3: Perception of HCWs regarding receiving/not receiving the Influenza vaccine (n=290).

| Reasons for receiving IV*	N (%)	Reasons for not receiving IV	N (%)
I have been offered official MOH IV Guidelines		I am not concerned	
Agree	172 (60.6)	Agree	47 (16.2)
Disagree	112 (39.4)	Disagree	243 (83.8)
I believe I have sufficient knowledge about IV		Vaccination causes influenza	
Agree	180 (63.6)	Agree	44 (15.2)
Disagree	103 (36.4)	Disagree	246 (84.8)
To protect myself against flu		I trust in/ Wish to challenge my natural immunity	
Agree	176 (60.7)	Agree	30 (10.3)
Disagree	114 (39.3)	Disagree	260 (89.7)
I care about my client's patients		The vaccine was not available	
Agree	130 (44.8)	Agree	24 (8.3)
Disagree	160 (55.2)	Disagree	266 (91.7)
I have child contact at home		Not all strains are covered	
Agree	84 (29.0)	Agree	21 (7.2)
Disagree	206 (71.0)	Disagree	269 (92.8)
To prevent cross inflection		It is better to get the flu than to take the vaccine	
Agree	81 (27.9)	Agree	17 (5.9)
Disagree	209 (72.1)	Disagree	273 (94.1)
It is required by my institution		Prior experience of severe localized reaction	
Agree	63 (21.7)	Agree	4 (1.4)
Disagree	227 (78.3)	Disagree	286 (98.6)
I have it routinely as annual immunization		Allergy to vaccine	
Agree	45 (15.5)	Agree	8 (2.8)
Disagree	245 (84.5)	Disagree	282 (97.2)

*IV= Influenza vaccine.
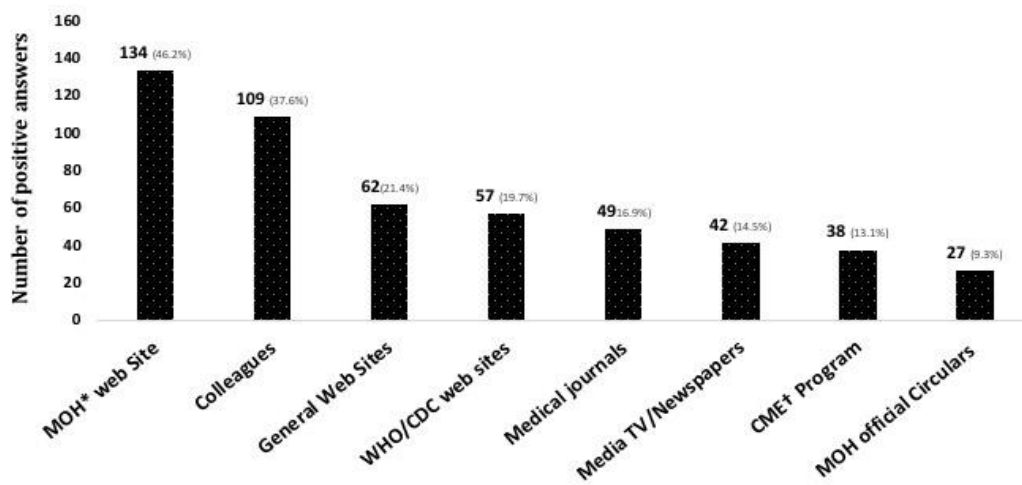
Figure 2: Sources of knowledge of health care workers about Influenza vaccine.

* Ministry of Health
† Continuous Medical Education

Table 4: Predictors for receiving Influenza vaccination consecutively during past three years (2016-2018).

Predictor	Received Influenza vaccine annually (seasons 2016-2018)					
	Yes N (%)	No N (%)	χ2	df	P value	95% CI
Age group (n=261)						
20-29	11 (31.4)	24 (68.6)				
30-39	46 (25.7)	133 (74.3)	4.04	3	.256	.248-.265
40-49	16 (40.0)	24 (60.0)				
≥50	3 (42.9)	4 (57.1)				
Gender (n=283)						
Male	16 (19.5)	66(80.5)	5.72	1	.020	.017-.023
Female	68 (33.3)	133 (66.2)				
Marital Status (n=283)						
Single	31 (36.9)	53 (63.1)				
married	48 (25.4)	141 (74.6)	5.79	2	.055	.050-.059
Divorced /widow	5 (50.0)	5 (50.0)				
Have children under 16 years (n=277)						
Yes	43 (27.4)	114 (72.6)	.39	1	.603	.593-.612
No	37 (30.8)	83 (69.2)				
Job Category (n=262)						
Nurse	40 (39.6)	61(60.4)				
Doctor	28 (31.5)	61(68.5)	7.95	2	.023	.02-.026
Technician	14 (19.4)	58 (80.6)				
Duration of work at PHC (n=278)						
< 10 yeas	39 (26.9)	106 (73.1)				
10-29 years	44 (34.4)	84 (65.6)	3.82	2	.131	.125-.138
≥ 30years	3 (60.0)	2 (40.0)				
Educational level (n=279)						
Board/ fellowship/ PhD/ MD	10 (45.5)	12 (54.5)				
diploma/master	27 (30.7)	61 (69.3)	3.79	3	.29	.279-.297
Bachelor	32 (25.8)	92 (74.2)				
less than Bachelor	15 (33.3)	30 (66.7)				
Number of patients seen/day						
<100	67 (29.0)	164 (71.0)				
100-200	7(38.9)	11(61.1)	1.29	2	.558	.549-.568
>200	6 23.1)	20 (76.9)				
Have any medical condition* (n=288)						
Yes	18 (31.6)	39 (68.4)	.063	1	.801	.866-.879
No	69 (29.9)	162 (70.1)				
Read the official MOH IV Guidelines (n=282)						
Yes	66 (38.6)	105 (61.4)	14.70	1	0.000	
No	19 (17.1)	92 (82.9)				
Do you feel that you have a sufficient knowledge about IV (n=282)						
Yes	62 (34.6)	117 (65.5)	6.39	1	0.011	
No	21 (20.4)	82 (79.6)				

*Medical condition of any of the followings, Diabetes Mellitus, hypertension, Bronchial Asthma, Chronic lung disease, Chronic heart disease, Chronic renal Disease, or immunodeficiency disease

Table 5: Binomial logistic regression of covariates for receiving Influenza vaccination consecutively during past three years (2016-2018).

Predictors for compliance to influenza vaccine	β	SE β	Wald's χ2	df	P	e β OR	95% CI	95% CI
Constant	-.714	.745	.917	1	.338			
Age group	-.025	.309	.007	1	.934	.975	.532	1.788
sex	.877	.372	5.561	1	.018	2.403	1.160	4.981
Marital Status	.965	.414	5.427	1	.020	2.625	1.165	5.911
Having children below 16 years	-.059	.403	.021	1	.884	.943	.428	2.079
Having chronic illness	.209	.403	.270	1	.603	1.233	.560	2.716
Job category	.434	.214	4.091	1	.043	1.543	1.014	2.349
Duration of work at the PHC	-.662	.376	3.096	1	.078	.516	.247	1.078
Test			χ2	df	P			
Overall model evaluation								
Likelihood ratio test			20.259	7	.005			
Score test			19.314	7	.007			
Wald test			36.947	1	.000			
Goodness-of-fit test								
Hosmer & Lemeshow			3.892	8	.867			

Cox and Snell R = .085. Nagelkerke R^2 = .121.

DISCUSSION

The current study was conducted at PHC in Jeddah (West of SA) to determine prevalence, attitudes, barriers, and predictors of IV. Prevalence showed a progressive reduction in the rate of the vaccination rate over the past three years, 53.3 % in 2016, 52.6% in 2017, and 51.7% in 2018, however, the reduction was minimal. Comparable results were found among HCWs locally, as a study from PHC in Arar city (North of SA) in 2018, reported an IV rate of 55.9% [21]. The low vaccination complaisance (30.2%) for three consecutive years (2016-2018) was parallel to a similar study conducted in Jeddah city during both 2016 and 2017, which reported that 34% of participants received the vaccine [22]. Different regions of SA also reported different prevalence rates. A study at PHC in Riyad and Hail city (center of SA) in 2016, showed higher vaccination rate (67.6%) [23], while a study conducted at Saudi hospital in Al-Ahsa (East of SA) in 2008–2009 showed lower rate (34.4%) [24]. This discrepancy in vaccination rates was similarly described in many studies and reviews worldwide. In a survey across the European Union, Norway, and Iceland (2008-2009), the estimates on vaccine rates varied among HCWs by countries from 13.4% -89.4% [25]. Reports from different surveys from multiple countries indicated vaccination coverage among HCWs below 50% [26-28]. Low vaccination coverage rate (42%) was also reported by NHIS 2004 survey [15].

In this study, the bivariate analysis indicated a strong association between knowledge of HCWs and compliance towards vaccination as both reading the official MOH IV Guidelines and feeling of having sufficient knowledge about IV were highly significant (p<.01). A fact pointing to the critical role of the MOH in enhancing the IV vaccine.

Although the proportion of HCWs who intended to receive the vaccine in the future was reasonable (66.2%), the actual compliance to vaccination was low; this fact coincided with other studies, which reported that the intention to receive the IV was higher than vaccine uptake [29]. Probably indicates the importance of other predicting factors such as self-perception about the vaccine (being not concerned, believing IV itself may cause influenza, or wishing to challenge their immune-system) or because of prior experience of severe localized reaction or allergy. This negative attitude towards the IV, in particular, the high percentage of HCWs who were not concerned about IV raises an important ethical question, as it seems that they were not very concerned about the impact of the IV on themselves, as well as on their patients.

Nevertheless, the relationship between HWCs' risk perceptions and vaccine-related behavior is not yet apparent, and factors influencing compliance need to be further studied, as stated by Yiwen et al. [30, 31]. In agreement with Burls's systematic review, the results of this study also revealed that vaccine-associated adverse side effects were minor reasons for rejecting the vaccine [32].

The greatest motivator for up taking the IV was to protect the self against flu, and this was consistent with the findings of many studies [16, 32, 33]. Similar to Burls's systematic review and Takayanagi et al., the second in the rank of vaccine motivation was the desire to prevent cross-infection [16, 32]. Another important influencing factor for receiving the IV is HCWs awareness about the availability of the IV, as 8.3% of HCWs in this study were unaware of the availability of the IV in the PHC, we found this proportion to be within the reported range (3-53%) by Burl's systematic review [32].

Unlike several studies that reported higher rates of receiving the IV among older HCWs [16, 21, 27, 31, 34], results obtained from this study showed that the highest rate of IV vaccine was among the middle age group (30-39 years) however the difference was not of statistical significance.

The unconfounded predictors of IV identified by the logistic regression analysis indicated that single female nurses were more likely to be immunized against influenza than married or others (divorced or widowed), males, or physicians and technicians. In the literature, studies of the influence of sex and job title on IV yielded controversial results [16]. The positive association between receiving IV and sex was reported by a study conducted in a Saudi hospital [24], on the contrary, results from a critical appraisal of the literature [31], and result from many studies in Spain.

The Middle East [27, 35], indicated that males were more likely to receive the IV than females. However, many other studies did not reveal any sex differences [12]. Where is in respect to job title, some studies indicated that physicians were more complaint to IV than nurses [16, 21]. Nevertheless, similar to the current study, a higher rate of vaccination among nurses was reported from a tertiary care hospital in SA after an annual seasonal influenza vaccination campaign [36]. Coinciding with Alenazi et al. in Arar city SA, the current study did not detect any difference in vaccination rate concerning the duration of service at the healthcare [21]. On the other hand, Haridi et al., in a study of IV determinants among healthcare workers in a tertiary care hospital in SA, found that more extended periods of practice independently predicted IV [37].

Limitations of this study included the possibility of bias as self-reported IV during the past three years may be subjected to reporting bias. However, earlier studies showed this method is a valid measure of influenza immunization status [38]. Besides, the inappropriateness of the study design to establish causality links between covariates and compliance to IV entails the conduction of longitudinal studies of determinants of IV. The strength of the current research lies in the validity and reliability of both the dependent variable (vaccination status) and the covariates (e.g., having chronic health conditions), which have already been established by the literature, thus confirming the overall consistency of the study.

CONCLUSION

The overall immunization coverage among HCWs remains suboptimal. The fact that the MOH Web site constituted the most frequent source of information about vaccination, and that reading the official MOH IV guidelines had a strong statistical association with a positive attitude towards vaccination, emphasizes the role of governmental authorities in enhancing vaccine among the HCWs. The part of the MOH is to overcome barriers for vaccine uptake through carefully designed educational programs and campaigns.

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