

RESEARCH PAPER



Knowledge and healthcare professionals' perceptions of influenza vaccination in the Qassim region, Saudi Arabia (2019–2020)

Nehal Alharbi, Areej Almutiri, Futon Alotaibi, and Amal Ismail 

Department of Pharmacy Practice, Unaizah College of Pharmacy, Qassim University, Unaizah, Saudi Arabia

ABSTRACT

Influenza is associated with a substantial economic burden owing to the extensive immediate and circuitous medicinal service costs at the individual and institutional levels. We aimed to evaluate healthcare workers' perceptions of the influenza vaccination in the Qassim region in Saudi Arabia. A cross-sectional study was conducted at selected hospitals from November to March 2020, in which healthcare workers completed a self-administered questionnaire. Of 327 participants, most were equally distributed between the ages 18–30 and 31–45 years (42.8% each), with 57.5% female and 42.5% male. Both Saudi (47.7%) and non-Saudi participants (52.3%) were included. The majority were physicians (29.7%), pharmacists (28.1%), and nurses (27.5%). Overall, 60.9% had good knowledge, 89% had positive perceptions, and 10.7% had negative perceptions. The primary reason for not getting vaccinated was a concern for complications. Moreover, 20.8% had never previously been vaccinated. Knowledge was positively correlated with nationality, educational level, and perception ($p = .002$, $p = .047$, and $p = .021$, respectively). Perceptions were significantly correlated with nationality ($p = .009$). Furthermore, 24.5% completely disagreed with compulsory vaccination and believe it would not improve coverage. Once fitted using a multinomial regression model, an r-square value of 0.026 indicated that nationality and history of previous vaccination significantly contributed to negative perceptions. We concluded that most healthcare workers had good knowledge and positive perceptions, and more than a third of the participants adhered to seasonal vaccination. Saudi patients and those who had never been vaccinated were more likely to have negative perceptions.

ARTICLE HISTORY

Received 10 June 2020
Revised 16 August 2020
Accepted 2 September 2020

KEYWORDS

Influenza vaccine; Qassim; perception; knowledge; healthcare workers

Introduction

The severity of the infection, death rates, and costs involved in the management of influenza tend to be higher among high-risk groups. The disease causes a considerable economic burden on healthcare organizations. Since anti-viral chemoprophylaxis is ineffective for the treatment and prevention of influenza, vaccination is the primary method of controlling its spread. In 2012, the World Health Organization (WHO) updated its recommendations regarding the vaccination of healthcare workers (HCWs), concluding that “HCWs are an important priority group for influenza vaccination, not only to protect the individual and maintain healthcare services during influenza epidemics but also to reduce the spread of influenza to vulnerable patient groups.”¹

The WHO Global Influenza Strategy (2019–2030) supports this by encouraging nations to “develop and implement national, seasonal vaccination policies for HCWs and other high-risk groups.”² Although the Saudi Ministry of Health offers inactivated influenza vaccinations annually and free of charge to all those over the age of six months, rates of influenza vaccination among HCWs were previously reported as low in 2014. Alshammari et al. reported a coverage of 38% in six major hospitals in the Riyadh and Hail regions.³

Furthermore, in a recent study conducted in Qassim by Alsuhaibani, vaccination rates were higher, at 48.6%.⁴

Saudi Arabia, since it serves as a destination for millions of visitors annually from around the world, deserves more significant attention. There is a high possibility of transmission, carrying a real risk to the health of airport staff, HCWs, and contact civilians. Hence, the Saudi Thoracic Society has issued guidelines recommending the implementation of strict vaccination policies.⁵ Despite the recommendations, studies^{6,7} have shown lower vaccination rates and knowledge levels among HCWs. Vaccination of healthcare staff considerably reduces the risk of cross-transmission, thereby decreasing the spread of epidemics.^{6,7} Data on vaccination acceptance, its barriers, and awareness levels are scarce. To increase vaccination rates, there is an urgent need to evaluate and analyze the situation by exposing HCWs' attitudes and worries regarding vaccination.

In various studies,^{8,9} safety concerns were the most commonly mentioned reasons for hesitating to get vaccinated. Knowledge about the safety of the influenza vaccine is lacking. For instance, some believe that it is contraindicated during pregnancy because it contains hazardous additives that could induce allergies, or that the seasonal-influenza vaccine offers protection against the pandemic influenza. Moreover, there is a lack of awareness on the national guidelines or recommendations.^{8,9} Healthcare professionals also have many

misperceptions, which include the belief that HCWs are not vulnerable to influenza or are less susceptible than other people, and that influenza is considered a risk only for those who have a chronic illness. These ideas vary according to the category of HCW¹⁰

In a recent multicenter study in the Qassim region of Saudi Arabia, the majority (84.1%) of participants believed that the influenza vaccine was effective in preventing influenza infections. Of these, 94% were physicians, followed by pharmacists (89%) and nurses (83%). However, only 48.6% regularly got vaccinated when the vaccine was announced.

In this study, we aimed to evaluate HCWs' knowledge and perceptions of the influenza vaccine and the barriers contributing to suboptimal influenza vaccination coverage in the Qassim region of Saudi Arabia.

Methods and materials

Study design and settings

This prospective quantitative cross-sectional study conducted in the Qassim region of Saudi Arabia assessed HCWs (physicians, pharmacists, nurses, laboratory technicians) in different departments of four selected hospitals (King Saud Hospital and Hayat National Hospital in Unaizah, city; Buraidah Central Hospital in Buridah city; and Albadaya General Hospital in Albadaya city), which are considered major hospitals in the area providing health care services for the large population in the region. Participants were invited after contacting the different departments in the hospitals. All licensed Saudi and non-Saudi HCWs who were available during the period of data collection, had worked at the hospital for more than one year, and were willing to participate were included. The study started in September 2019 and ended in March 2020.

Sampling

We calculated the sample size using the Raosoft® Inc. online software program at a 5% margin of accepted error and a 95% confidence interval. For the response distribution, we assumed that 50% of participants would be vaccinated, which resulted in the estimated sample size of 327. We followed the stratified random sampling technique to recruit participants, and data collection continued until the calculated sample size sample was achieved.

Questionnaire

The participants completed a self-administered questionnaire. The questions were adapted from previous literature and contained four sections. The first part was designed to determine the general characteristics of the participants. The second part was designed to assess the participants' knowledge by providing a simple answer for "yes" or "no" questions as the nature of knowledge questions had only two possible responses. They received 1 point each for correct answers and 0 point for incorrect answers. HCWs were classified into two categories: those with good, and poor knowledge according to number of scored corrected answers, those gave 50% correct answers

score and more were classified as good knowledge while those got less considered of poor knowledge. In the third section, adherence to vaccination was assessed. The third part was composed of 5 Likert scale questions meant to assess the participants' perceptions on the influenza vaccination. Appropriate responses were scored, and participants were classified into positive or negative perception categories accordingly. The last section contained questions regarding the frequency and history of influenza vaccination among HCWs. Experts reviewed the questionnaire for further validation, and a pilot study was conducted. Those involved in the pilot study were not included in the results. Cronbach's alpha test was used for internal consistency, and further modifications were applied accordingly.

Ethics

Ethical approval was obtained from the research unit at the Unaizah College of Pharmacy and from the local research ethics committee (QREC). After being explained the purpose of the research and agreeing to participate, written informed consent was signed by the HCWs.

Statistical analysis

Data were entered into a spreadsheet (Excel, Microsoft Corporation, Redmond, WA, USA), and the statistical analysis was performed using SPSS version 21 (IBM Corporation, Armonk NY, USA). Information was coded and exported to SPSS for further processing and statistical testing. Frequencies and cross tabs were run. According to normality test results, data did not follow the normal distribution; therefore, non-parametric statistics were applied using the Spearman's correlation test. The multinomial regression model was fitted.

Results

The current study surveyed a total of 327 HCWs with ages ranging from 18 to 60 years old. The majority were equally distributed between the age groups 18–30 (42.8%) and 31–45 years old (42.8%). More than half of the participants were female (188; 57.5%), and around a half were non-Saudi (171; 52.3%). We found that 62.4% (204) were married, and 73.7% (241) reported that they were living with their families. Most of the participants had only graduated with bachelor degree (226; 69.1%). The participants' professions varied, but the majority were physicians (97; 29.7%). The survey sample included various departments and specialties, with 88 in pharmacy (26.9%), 51 in general practice (15.6%), 20 in internal medicine (6.1%), 17 in pediatrics (5.2%), 11 in obstetrics and gynecology (3.4%), 8 in family medicine (2.4%), and 132 were radiology specialists and technicians (40.4%). Most of the participants did not have a chronic disease (Table 1).

Of the 199 (60.9%) participants those who scored more than two correct answers out of five were classified as having good knowledge, Spearman's correlation found that non-Saudi participants showed significantly good knowledge ($p = .002$) compared to 81 Saudi healthcare workers who had good knowledge. Additionally, educational level was positively

Table 1. Healthcare workers' perceptions of the influenza vaccination according to their general characteristics.

Crosstab		Perceptions		
		Negative	Positive	P-value
n = 327				
Age	18–30	16	124	.971
	31–45	12	128	
	46–60	7	33	
	Over 60	0	7	
Sex	Male	16	123	.686
	Female	19	169	
Nationality	Saudi	24	132	.009
	Non-Saudi	11	160	
Educational level	Graduated	27	199	.321
	Master's degree	4	58	
	Doctorate	4	28	
	Post doctorate	0	7	
Profession	Physician	6	91	.076
	Pharmacist	7	81	
	Nurse	10	80	
	Radiology specialists and technicians	6	30	
	*Others	2	10	

*Others: nutritionists, lab technicians

correlated with the participants' level of knowledge about the influenza vaccine ($p = .047$) (Table 2). The majority of participants had positive perceptions of the influenza vaccination (292; 89.3%), and only 10.7% had negative perceptions. Most of the participants were physicians (29.7%) pharmacists (28.1%), and nurses (27.5%). Of those with positive perceptions, 54.7% were non-Saudi, and 45.2% were Saudi. Among Saudi HCWs, 33.3% were vaccinated every season, and 20% had not previously been vaccinated. Fourteen percent of Saudi HCWs had received the vaccine only once in their life, and 16% had received it only twice.

For non-Saudi HCWs, 37% were vaccinated every season, while 21.1% had not ever been vaccinated. A total of 19.3% of non-Saudi HCW had been vaccinated many times, but not every season. To determine the HCWs' perceptions, we focused on the factors contributing to influenza vaccine refusal among the non-vaccinated healthcare professionals. Thirty-one HCWs (9.5%) believed that herbals were better than vaccines, whereas 65 (19.9%) did not. Additionally, 13 (4%) believed that the vaccine could cause influenza and 68 (20.8%) did not (Table 3).

The multinomial regression model was fitted. A significant regression was found with an r-square value of 0.026. Table 4 provides an overview of the effect of demographic data on the participants' predicted negative perception. The binary dependent variable was coded as positive (coded on response 1) or negative (coded on response 2). The full model containing all predictors was statistically significant. For the χ^2 test (degrees of freedom [df] = 10, N = 327, positive = 292, negative = 35), the result was 20.375 ($p = .026$), indicating that the model distinguished between respondents with positive and negative perceptions of the influenza vaccination, the association of predicted probabilities, and observed responses. Nationality and previous vaccination history made significant unique contributions. In

Table 2. Healthcare workers' knowledge about the influenza vaccine.

Crosstab		Knowledge		
		Poor Knowledge	Good Knowledge	P-value
Count n = 327				
Age	18–30	56	84	.208
	31–45	62	78	
	46–60	9	31	
	Over 60	1	6	
Sex	Male	58	81	.412
	Female	70	118	
Nationality	Saudi	75	81	.002
	Non-Saudi	53	118	
Educational Level	Graduated	97	129	.047
	Master's degree	18	44	
	Doctorate	11	21	
	Post doctorate	2	5	
Specialty	General practice	20	31	.511
	Pediatrics	2	15	
	Family medicine	4	4	
	Internal Medicine	8	12	
	OB/GYN	3	8	
	Pharmacy	28	60	
	*Others	63	69	

*Others: nutritionists, lab technicians

other words, those who were Saudi and never previously vaccinated were more likely to have negative perceptions.

Discussion

The acceptance rates, frequency, and attitudes toward vaccination among HCWs are profoundly affected by beliefs and perceptions. In this study, we aimed to evaluate HCWs' perceptions and attitudes toward the influenza vaccine in the Qassim region of Saudi Arabia.

The participants' ages ranged from 18 to 60 years. There was an equal distribution of 42.8% (140) in the age ranges of 18–30 and 31–40 years old. This was different from Alsuhaibani's study, also conducted in the Qassim region of Saudi Arabia, in which most respondents were aged 30–39 years (209; 40.0%).⁴

In our study, more than half of the participants were female (188; 57.5%). This finding was consistent with results of other studies in Saudi Arabia, such as those conducted by Alsuhaibani (280; 53.9%), Alshammari et al. (225; 61.8%), and Awadalla et al. (181; 58.0%).^{3,4,6}

Approximately half of the HCWs who participated were non-Saudi, which was similar to the findings from Alsuhaibani's study (272; 51.1%), but less than that in the study conducted by Mojamamy et al, where more than half of the respondents were Saudi Arabian (315; 85.6%).^{4,11}

In our study, most of the participants had a Bachelor's degree (69.1%), and a small minority had a post-doctorate (7; 2.1%). Compared to participants in Awadalla et al.'s study, most of the participants in our study (44.9%) had secondary school diplomas. This could have been the result of the professional distribution of the participants.⁶ In our study, HCWs'

Table 3. Participants' perceptions of the influenza vaccination.

Perception	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Afraid of needles	6.4% (21)	15% (50)	26% (85)	24.2% (79)	28.1% (92)
Concern about the injection procedure	6.4% (21)	20.2% (66)	22.3% (73)	26.6% (87)	24.5% (80)
Concern about complications of the injected vaccine	6.1% (20)	28.4% (93)	21.4% (70)	27.2% (89)	16.8% (55)
Belief that influenza is not serious	7.3% (24)	20.2% (66)	17.7% (58)	34.9% (114)	19.9% (65)
Belief that vaccine can cause influenza	4.0% (13)	19.0% (62)	21.7% (71)	34.6% (113)	20.8% (68)
Belief that getting influenza is safer than getting vaccinated	7.0% (23)	16.8% (55)	19.6% (64)	31.2% (102)	25.4% (83)
Belief that herbals are better than the vaccine	9.5% (31)	18.7% (61)	25.1% (82)	26.9% (88)	19.9% (65)
Belief that vaccines are not effective	5.2% (17)	9.8% (32)	19.9% (65)	41.9% (137)	23.2% (76)

Table 4. Logistic regression analysis results showing that healthcare professionals who had never previously received the influenza vaccination were more likely to have negative perceptions.

Parameter Estimates		95% Confidence Interval for Exp(B)							
Perceptions ^a		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
Negative Perceptions	Intercept	-4.245	1.092	15.115	1	.000			
	Male	.424	.476	.795	1	.373	1.528	.601	3.884
	Female	0 ^b	.	.	0	.	.	.	.
	Saudi	.971	.442	4.833	1	.028	2.641	1.111	6.278
	Non-Saudi	0 ^b	.	.	0	.	.	.	.
	Physician	-.221	.703	.099	1	.753	.802	.202	3.182
	Pharmacist	.137	.618	.049	1	.824	1.147	.342	3.851
	Nurse	.670	.764	.771	1	.380	1.955	.438	8.732
	Others	.545	.979	.310	1	.577	1.725	.253	11.743
	Laboratory technician	0 ^b	.	.	0	.	.	.	.
	Never received the vaccine	1.995	.791	6.360	1	.012	7.354	1.560	34.673
	Received only once	1.087	.906	1.439	1	.230	2.965	.502	17.508
	Received only twice	1.424	.855	2.774	1	.096	4.155	.777	22.208
	Received every season	.791	.808	.957	1	.328	2.206	.452	10.758
	Received several times but not every season	0 ^b	.	.	0	.	.	.	.

^aThe reference category is positive perceptions

^bThis parameter is set to zero because it is redundant

professions were approximately evenly distributed between physicians, pharmacists, and nurses, with only 14.7% categorized as other health professions. In contrast, the majority of participants in the studies conducted by Alshammari et al., Mojamamy et al., and Alsuhaibani were nurses, accounting for 60.4%, 52.7%, and 44.9%, respectively.^{3,4,11}

The participants' knowledge assessment showed that the majority had good knowledge (61%), which was higher than that reported in southwestern Saudi Arabia.⁶ We found that knowledge was significantly correlated with educational level, which is consistent with the findings of a recent study from the eastern Mediterranean region.⁷ This was also consistent with the study by Awadalla et al, where non-Saudi respondents were more knowledgeable than Saudis.⁶

It is evident that there is a lack of knowledge about vaccination among Saudi HCWs. This reflects the valid need to evaluate medical professionals' curriculums for vaccination modules. Additionally, non-Saudi HCWs who participated in our study may have received well-established education about vaccination in their respective countries.

In addition, we found a correlation between having a Saudi nationality and negative perceptions, which was shown by the frequency of vaccination. We found that 20% of Saudi workers had never received the vaccine, 14% had only received it once,

and only 16% had received it every season. Therefore, there is a need to improve education about the influenza vaccination to eliminate the negative perceptions, reduce negative attitudes, and thus improve adherence.

Previous studies of Saudis have not focused on nationality, and therefore no similar results could be used for comparison.

Pharmacy was the most common specialty in our study (88; 26.9%), which was different from the study Alshammari et al, in which the majority were in general practice (123; 33.8%).³ Our findings showed a high level of positive perceptions, which is similar to the findings from another study that showed general positive attitudes toward influenza vaccination in HCWs in Saudi Arabia.³

Herbals were strongly believed by 9.5% of the participants to be better than the vaccine at protecting them from influenza, followed by the belief that influenza is not serious and that getting influenza is safer than getting vaccinated. However, the prevailing reason for participants not getting vaccinated was a concern regarding the complications from the vaccine. These findings were similar to those from another study conducted in Saudi Arabia in which fear of adverse reactions, belief that influenza is not a serious disease, and belief that the vaccine is not effective, were the most common barriers reported.³ However, a Pakistani study conducted by Ali et al. showed that the unfamiliarity with

the vaccine, availability, and cost were the main reasons.¹² Moreover, an Indian study showed low acceptance due to the negative perceptions concerned with safety and efficacy.¹³

Results from our model of regression analysis showed that HCWs who had never previously received the influenza vaccination were more likely to have negative perceptions.

Concerning the perception toward the establishment of a compulsory influenza vaccination, the participants' responses varied, with 45.5% disagreeing, 24.5% agreeing, and 30% feeling neutral. Previous studies had similar findings that obligatory vaccination is still a debate, a mixed designed study among HCWs in England showed a limited acceptance for the mandatory vaccination policy, since some HCWs consider it unethical to force a healthcare worker to receive it and should have the right to refuse, even though it would have a positive impact on coverage rates, thereby lowering the risk of influenza transmission and minimizing the burden of the disease.¹⁴

Attitudes toward influenza vaccination were the most significant indicators of HCWs intending to and getting vaccinated. Social standard methodology might be an intercession technique to shape HCWs' disposition toward and consequent receipt of the vaccination.¹⁵

Study limitations

Since influenza vaccine coverage is beyond the scope of this study, the purpose was not to assess the acceptance rate but rather to study HCWs' perceptions of influenza vaccination. We are convinced that HCW vaccination coverage rates need to be increased by removing the HCWs' negative perceptions about the vaccine.

Although the study was conducted in major hospitals in the region, the hospitals and participants might still compromise the generalizability of the results and carry an expected potential bias. Moreover, the self-administered nature of the questionnaire and dichotomous type of questions for knowledge might carry the risk of recall bias, which may affect the results and limit its utility. Furthermore, surveyed subjects who participated in vaccination-related work were not excluded from the study.

In conclusion, the majority of HCWs showed good knowledge and positive perceptions of the influenza vaccine. More than a third of our participants received the vaccine annually, while 20.8% had never been vaccinated. The most reported cause for not receiving the influenza vaccination was a concern for complications arising from the injected influenza vaccine. Saudi participants and those who had never previously been vaccinated were more likely to have negative perceptions. Positive perceptions were significantly correlated with knowledge about the vaccine. A third of HCWs disagreed with the establishment of a compulsory vaccination program and believed it would not be effective for improving the influenza vaccination coverage.

To improve rates, we recommend that vaccination modules be covered in the curriculum of all health profession programs to improve future HCWs' knowledge, which in turn will be reflected in their positive perception. We suggest encouraging education by conducting annual events prior to the vaccination announcement to enhance HCWs' vaccination rates. We would also recommend establishing an annual analysis report

of the number of un-vaccinated HCWs and their reason for not receiving the vaccination to eliminate the reason cited by these HCWs, remove the negative perceptions, and improve adherence to vaccination in the coming seasons.

Acknowledgments

We express our gratitude to all the healthcare workers who participated in the study and for the deanship of Unaizah College of Pharmacy.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Funding

This study received no funding.

ORCID

Amal Ismail  <http://orcid.org/0000-0003-4398-6642>

Declaration of interest

None of the authors have any conflicts of interest to disclose

References

1. Abalkhail MS, Alzahrany MS, Alghamdi KA, Alsoliman MA, Alzahrani MA, Almosned BS, Tharkar GS. Uptake of influenza vaccination, awareness and its associated barriers among medical students of a University Hospital in Central Saudi Arabia. *J Infect Public Health*. [Internet]. 2017;10:644–48. Elsevier BV. doi:10.1016/j.jiph.2017.05.001.
2. Palache B, Barbosa P. Global influenza vaccine distribution survey demonstrates urgency of implementation of objective 3 of WHO influenza strategy 2019-2030. *Inter Med Rev*. [Internet]. 2020. Knowledge Enterprise Journals. doi:10.18103/imr.v6i2.850.
3. Alshammari TM, Yusuff KB, Aziz MM, Subaie GM. Healthcare professionals' knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: a multicenter cross-sectional study. *BMC Health Serv Res*. [Internet]. 2019;19. Springer Science and Business Media LLC. doi:10.1186/s12913-019-4054-9.
4. Alsuhaibani M. Barriers and beliefs among healthcare workers regarding seasonal influenza vaccine in Al-Qassim region, Saudi Arabia. *Hum Vaccin Immunother*. [Internet]. 2019;16:313–20. Informa UK Limited. doi:10.1080/21645515.2019.1656020.
5. Al-Hajjaj M, Alharbi N, Zeitouni M, Idrees M, Al-Barrak A, Al-Moamary M, Al-Ghobain M, Al-Shimemeri A. The Saudi thoracic society pneumococcal vaccination guidelines-2016. *Ann Thorac Med*. [Internet]. 2016;11:93. Medknow. doi:10.4103/1817-1737.180030.
6. Awadalla NJ, Al-Musa HM, Al-Musa KM, Asiri AM, Albariqi AA, Majrashi HM, Alasim AA, Almslah SA, Alshehri TK, Alflan MA. Seasonal influenza vaccination among primary health care workers in Southwestern Saudi Arabia. *Hum Vaccin Immunother*. [Internet]. 2019;16:321–26. Informa UK Limited. doi:10.1080/21645515.2019.1666500.
7. Zaraketa H, Abubakar A. Harnessing the power of advocacy to improve seasonal influenza vaccination coverage in the Eastern mediterranean region. *East Mediterr Health J*. [Internet]. 2020;26:138–40. World Health Organization Regional Office for the Eastern Mediterranean (WHO/EMRO). doi:10.26719/2020.26.2.138.

8. Yaqub O, Castle-Clarke S, Sevdalis N, Chataway J. Attitudes to vaccination: A critical review. *Soc Sci Med.* [Internet]. 2014;112:1–11. Elsevier BV. doi:10.1016/j.socscimed.2014.04.018.
9. Alqahtani AS, Althobaity HM, Al Aboud D, Abdel-Moneim AS. Knowledge and attitudes of Saudi populations regarding seasonal influenza vaccination. *J Infect Public Health.* [Internet]. 2017;10:897–900. Elsevier BV. doi:10.1016/j.jiph.2017.03.011
10. Dini G, Toletone A, Sticchi L, Orsi A, Bragazzi NL, Durando P. Influenza vaccination in healthcare workers: A comprehensive critical appraisal of the literature. *Hum Vaccin Immunother.* [Internet]. 2017;14:772–89. Informa UK Limited. doi:10.1080/21645515.2017.1348442.
11. Mojamamy GM, Albasheer OB, Mahfouz MS. Prevalence, knowledge, attitude, and practices associated with influenza vaccination among healthcare workers in primary care centers in Jazan, Saudi Arabia: A cross-sectional study. *Trop J Pharm Res.* [Internet]. 2018;17:1201. African Journals Online (AJOL). doi:10.4314/tjpr.v17i6.29.
12. Ali I, Ijaz M, Rehman IU, Rahim A, Ata H. Knowledge, attitude, awareness, and barriers toward influenza vaccination among medical doctors at tertiary care health settings in Peshawar, Pakistan—a cross-sectional study. *Front Public Health.* 2018;6:173. Published 2018 Jun 27. doi:10.3389/fpubh.2018.00173.
13. Bali NK, Ashraf M, Ahmad F, Khan UH, Widdowson M-A, Lal RB, Koul PA. Knowledge, attitude, and practices about the seasonal influenza vaccination among healthcare workers in Srinagar, India. *Influenza Other Respir Viruses.* 2013;7(4):540–45. doi:10.1111/j.1750-2659.2012.00416.x.
14. Stead M, Critchlow N, Eadie D, Sullivan F, Gravenhorst K, Dobbie F. Mandatory policies for influenza vaccination: views of managers and healthcare workers in England. *Vaccine.* [Internet]. 2019;37:69–75. Elsevier BV. doi:10.1016/j.vaccine.2018.11.033.
15. Ng TWY, Cowling BJ, So HC, Ip DKM, Liao Q. Testing an integrative theory of health behavioural change for predicting seasonal influenza vaccination uptake among healthcare workers. *Vaccine.* [Internet]. 2020;38:690–98. Elsevier BV. doi:10.1016/j.vaccine.2019.10.041.