

Willingness to vaccinate against Novel COVID-19 and contributing factors for the acceptance among nurses in Qassim, Saudi Arabia

A.H. ALDOSARY¹, G.H. ALAYED²

¹Department of Family and Community Medicine, College of Medicine and Medical Sciences, Qassim University, Al Qassim, Saudi Arabia

²College of Medicine and Medical Sciences, Qassim University, Al Qassim, Saudi Arabia

Abstract. – OBJECTIVE: The aim of the article is to determine the level of COVID-19 vaccine acceptance among nurses. It also aimed to identify contributing factors of COVID-19 vaccine hesitancy among nurses in Qassim, Saudi Arabia.

MATERIALS AND METHODS: This cross-sectional study was carried out on nurses working in Ar-Rass general hospital and primary care centers, Qassim, Saudi. A self-administered questionnaire was collected between 27/11/2020 to 7/12/2020. The questionnaire consists of socio-demographics, knowledge, and practice in regard to coronavirus, attitude toward vaccinations, coronavirus vaccine acceptance, and reasons for hesitancy.

RESULTS: Out of 468 nurses, 334 nurses completed the survey. Overall, (236) 70.7% of nurses were willing to uptake coronavirus vaccine, which is a relatively high acceptance rate. 78.7% believe that COVID-19 vaccination should be mandatory once available. The main four reasons for hesitancy were the lack of knowledge 23.1%, long term adverse effects 17.7%, short-term side effects of the vaccine 9.3%, non-effective vaccine 8.7%.

CONCLUSIONS: The findings presented in this study can help Saudi Arabian health authorities to tailor educational campaigns for nurses and development of effective vaccination programs to increase the novel vaccine acceptance and uptake among nurses' population.

Key Words:

Nurses, COVID-19 vaccine, Acceptance, Factors, Hesitancy, Saudi Arabia.

Introduction

In March 2020 World Health Organization (WHO) declared a pandemic¹. On March 2, 2020,

the Saudi ministry of health announced the first coronavirus case in Saudi Arabia². By February 27, 2021, Coronavirus Disease 2019 (COVID-19) has infected 112,649,371 people all over the world, including 2,501,229 deaths, reported to WHO³. The virus has been imposing a significant burden on the public health system. Yet, no effective therapeutic options for this infection; avoiding exposure by social distancing and lockdowns is the only way of infection prevention. The resurgence of outbreaks has often been noted when restrictions are removed^{4,5}. Since immunization by vaccines is an effective way to eradicate infectious diseases, an effective vaccine against COVID-19 is needed⁴.

On December 10, Saudi Arabia's Food and Drug Authority announced the approval of the coronavirus vaccine⁶. The administration of the vaccine was done in three phases, covering a specific population in each phase. Health care providers are covered in the first phase as recommended by the World Health Organization and the Centers for Disease Control and Prevention (CDC), considering the increased risk of coronavirus infection during the fight against this pandemic^{7,8}. The effort of the researchers developing coronavirus vaccinations and the efforts of the local health care authorities to provide the vaccine may be wasted by a diffuse hesitancy in the uptake of the vaccination. Vaccine hesitancy phenomenon, in general, is an important and growing issue, listed by the WHO in 2019, among the ten threats to public health globally⁹. For instance, the uptake of the H1N1 influenza vaccine was reported as low all over the world¹⁰.

Since the development and availability of the vaccine do not mean acceptance and uptake of the vaccination, assessment of the population's intentions to vaccinate against COVID-19 is essential. Especially healthcare workers¹¹. Health care worker's hesitancy regarding the COVID-19 vaccine may reduce the confidence in the vaccination among the general population since people trust vaccination opinions of health care providers¹².

Promoting the acceptance and uptake of the vaccination among health care providers is significantly important, not only protecting the health care providers, who are more at risk of getting infected, but also lowering the chances of infecting their patients, family, and community. Designing strategies that encourage health care workers to uptake the coronavirus vaccine is vitally important to prevent the spread of coronavirus infection. Identifying the factors increasing the willingness of health care providers to vaccinate against coronavirus may help. Work-related factors may include: 1. the department in which they work (high-risk for COVID-19 and non-high-risk department); 2. Encountering any patients suspected/confirmed with COVID-19 or not. While 1. history of any chronic condition 2. Socio-demographics may present as personal factors affecting the acceptance of the vaccination against COVID-19. Other factors are being uncertain in regard to the efficacy, effectiveness, or safety of the potential vaccine and believing that there is no need for a coronavirus vaccine¹¹.

Nurses are at higher risk of getting coronavirus infection due to more and longer contact with infected patients¹². Despite the higher risk of infections, a systematic review presented a concerning finding/result showing a low uptake rate of vaccinations in multiple studies¹³. Regarding the COVID-19 vaccine, fewer nurses intended to vaccinate compared to physicians in more than one study^{14,15}. Even with the progression of the coronavirus pandemic, the results of a study conducted on nurses in Hong Kong showed a high level of vaccine hesitancy for the COVID-19 vaccine with only a 40.0% acceptance rate¹¹. In another study, 63% of nurses were intended to vaccinate against coronavirus¹⁶.

In Saudi Arabia, only three studies assessed the acceptance of the coronavirus vaccine. Two studies^{17,18} included the general population; one showed that 64.7% of the respondents intended to take the vaccine¹⁷. The other study¹⁸ showed 44.7% accepted coronavirus novel vaccine. A

third study¹⁹ included health care workers where 70% acceptance rate is shown. However, no study targeted nurses at higher risk of infections¹³.

Understanding what factors affect the intentions of nurses to uptake the COVID-19 vaccine is crucial to help in the development of strategies to increase the uptake. The knowledge about these factors is insufficient¹². Thus, the aim of this study is to determine the level of coronavirus vaccine acceptance and to identify the contributing factors of COVID-19 vaccine hesitancy among nurses in the Qassim region.

Materials and Methods

This observational cross-sectional study was conducted in general hospital and all primary health care centers in Ar-Rass – Qassim region. All nurses working in the government hospital and governmental primary health care centers in Ar-Rass were included. The number of nurses registered in general authority for statistics is as the following: 370 nurses in the governmental hospital, 98 nurses in all 13 governmental primary health care centers in Ar-Rass, a total of 468 nurses were included. All nurses working at the time of the data collection were included. The response rate was approximately 71.4%, with 334 responses. For data collection, we constructed a self-administered questionnaire based on the literature review. The questionnaire consisted of socio-demographic, knowledge, and practice in regard to coronavirus, attitude toward vaccinations, coronavirus vaccine acceptance, and reasons for hesitancy.

The data collection period was from 27/11/2020 to 7/12/2020. Our questionnaire started with an agreement statement explaining the purpose of the study. An electronic consent form was sent to nurses working in primary health centers in Ar-rass. The nurses who agreed to participate in the study completed the questionnaire on their own phones. We pre-tested the questionnaire on nurses to ensure the clarity of the questions and edited it accordingly. After the testing, we compared the sample characteristics with the statistics of the nurse's population, looking for potential selection bias.

The study was approved by the Regional Research Ethics Committee under the General Directorate of Health Affairs/Ministry of Health in Qassim Province. All participants received

written informed consent, and the information is confidential with no identifiers. The Regional Research Ethics Committee's Approval Number is 1442-655384.

Statistical Analysis

Data were collected as described previously and entered into a spreadsheet where data cleaning was done. Following this, the cleaned data was transferred to IBM SPSS Statistics version 22 for analysis (IBM Corp., Armonk, NY, USA). Descriptive analyses were carried out to summarize and describe the data across the questions asked of the study participants. The results relating to the demographics, knowledge, and practices regarding COVID-19, attitudes toward vaccinations, and reasons of hesitancy to COVID-19 vaccine were presented in frequency and proportion tables as well as charts. Data from all the questions were analyzed using descriptive statistics, and the results were presented in tables and charts as necessary.

A set of questions were added together to form composite outcome measures for both knowledge and practices regarding COVID-19. More specifically, the following three questions: "believe COVID is a serious disease", "COVID-19 has changed my work/professional life", and "COVID-19 has changed my social life" were added up as a composite outcome measure to represent knowledge about COVID. These were the most comparable and relevant COVID-19 knowledge-related questions that can be summed up in a meaningful statistical way to represent knowledge as a study outcome. The Cronbach's alpha for the composite outcome was determined to be 0.754, indicate excellent reliability and internal consistency. Similarly, the following three questions: "follow measures to protect self and others like social distancing", "follow measures to protect self and others like wearing masks" and "follow measures to protect self and others like hand washing/sanitizing" were added up to form a composite outcome measure for practice regarding COVID-19. The Cronbach's alpha for the practice outcome was found to be 0.919, suggesting strong reliability and internal consistency. Because questions about vaccine attitudes cannot be added together in a meaningful way using a scoring system due to heterogeneity in the structure of the questions, the question on the acceptance of the COVID-19 vaccine was used as an outcome measure for vaccine hesitancy among

the participants. Using the derived outcome measures, the tests of associations were carried out to determine the presence and magnitude of relationships between variables. The chi-square test was carried out to test for associations between categorical variables, while the unpaired *t*-test was carried out to determine associations between continuous variables. All tests were carried out at a level of significance <0.05 .

Results

Socio-demographic characteristics: in line with the methodology described in the preceding section, a total of 334 participants participated and provided data on their knowledge and practices regarding COVID-19, as well as their attitudes towards COVID-19 vaccination. The largest proportion of the participants were less than 30 years of age (45.3%), followed by those between 30 and 40 years (37.7%; Table I). The remaining participants were older (41 years and above). As much as 92.5% of the participants were females. Regarding nationality, 68.9% of the participants were non-Saudi nationals, and just 31.1% were natives of Saudi Arabia. More of the participants were married (57.5%), and another 38.3% were still single at the time of data collection. The remaining were either widowed (1.2%) or divorced (3.0%). Many of the participants were working in different departments, with 34.4% involved in in-patient care, 12.6% working in emergency units, 14.1% working in the Intensive Care Unit (ICU), 6.3% in outpatient departments, and 5.4% in the operating room, 19.5% worked in primary health care. Only 5.7% worked in administration, and another 2.1% worked in health education. When asked about their length of experience, the majority have had less than 10 years of experience (66.5%), followed by those who have worked for between 10 and 20 years (27.2%), and those who have worked for longer than 20 years (6.3%). Health-wise, 18.6% reported having at least one type of chronic disease, and the most prevalent chronic diseases among the 62 participants who indicated they have a chronic disease are asthma (29.0%), hypertension (27.4%), diabetes mellitus (17.7%), and thyroid disease (17.7%). Up to 77.5% of the participants indicated that they had attended lectures/discussions about COVID-19, and 70.1% said that they had encountered a confirmed COVID-19 patient.

Table I. Sociodemographic characteristics of the study population (n = 334).

Variable	Values	Frequency	Percent
Gender	Female	309	92.5%
	Male	25	7.5%
Age	< 30 years	151	45.2%
	30-40 years	126	37.7%
	41-50 years	46	13.8%
	> 50 years	11	3.3%
	Nationality	Non-Saudi	230
	Saudi	104	31.1%
Marital status	Single	128	38.3%
	Married	192	57.5%
	Widowed	4	1.2%
	Divorced	10	3.0%
Chronic disease	No	272	81.4%
	Yes	62	18.6%
Type of chronic disease (n = 62)	Anemia	3	4.8%
	Asthma	18	29.0%
	Cardiac disease	3	4.8%
	Chronic kidney disease	2	3.2%
	Diabetes mellitus	11	17.7%
	Hypertension	17	27.4%
	Thyroid disease	11	17.7%
	Psychiatric illness	3	4.8%
	Department	In patient	115
Primary health care		65	19.5%
Intensive care		47	14.1%
Emergency		42	12.6%
Outpatient		21	6.3%
Operating room		18	5.4%
Administration		19	5.7%
Health education		7	2.1%
Years of experience	< 10 years	222	66.5%
	10-20 years	91	27.2%
	> 20 years	21	6.3%
Attended lectures about COVID-19	No	75	22.5%
	Yes	259	77.5%
Encountered a confirmed COVID-19 patient	No	100	29.9%
	Yes	234	70.1%

Knowledge and Practices Regarding COVID-19

Regarding nurses’ knowledge of COVID-19, most of the population appears to have excellent knowledge of the disease (Table II). As much as 95.8% of the participants agreed or strongly agreed with the statement that COVID-19 is a serious disease. In terms of impacts, 48.8% strongly agreed that COVID-19 changed their work/professional life, and another 39.5% agreed with this. Similarly, 56.0% strongly agreed that their social life changed due to COVID-19, with another 39.8% agreeing with this.

Going further to examine practices relating to COVID-19, as much as 97.6% of the participants strongly agreed or agreed that they are following

preventive measures to protect themselves and others, such as social distancing. In the same manner, a large proportion strongly agreed (73.4%) or agreed (28.4%) that wearing masks is a way of protecting themselves and those around them. Regarding handwashing and sanitizing, a total of 98.6% of the entire study population have been carrying out this measure as a COVID-19 protection/prevention measure. Regarding the statement that “I think a vaccine is needed for COVID-19” about 64.7% and 28.1% of the respondents strongly agreed and agreed respectively with this statement. Whereas very few respondents of about 1.8% disagreed and 5.4% were of neutral opinion. Also, 85.3% of the participants feel that they are at risk of being infected by COVID-19.

Table II. Knowledge and practices regarding COVID-19 (n = 334).

Variable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Knowledge					
Believe COVID is a serious disease	1 (0.3%)	4 (1.2%)	9 (2.7%)	128 (38.3%)	192 (57.5%)
COVID-19 has changed work/professional life	2 (0.6%)	9 (2.7%)	28 (8.4%)	132 (39.5%)	163 (48.8%)
COVID-19 has changed social life	1 (0.3%)	5 (1.5%)	8 (2.4%)	133 (39.8%)	187 (56.0%)
Practice					
Follow measures to protect self and others like social distancing	0 (0.0%)	1 (0.3%)	7 (2.1%)	85 (25.4%)	241 (72.2%)
Follow measures to protect self and others like wearing masks	1 (0.3%)	0 (0.0%)	3 (0.9%)	85 (25.4%)	245 (73.4%)
Follow measures to protect self and others like hand washing/ sanitizing	0 (0.0%)	1 (0.3%)	4 (1.2%)	80 (24.0%)	249 (74.6%)
Think a vaccine is needed for COVID-19	2 (0.6%)	4 (1.2%)	18 (5.4%)	94 (28.1%)	216 (64.7%)
Feel at risk of being infected by COVID-19	4 (1.2%)	6 (1.8%)	39 (11.7%)	126 (37.7%)	159 (47.6%)

Knowledge score: mean (SD) – 13.3 (1.7), range: 6.0-15.0. Practice score: mean (SD): 14.1 (1.4), range: 8.0-15.0.

As described in the methodology, participant responses were aggregated to determine knowledge and practice scores. The average knowledge score for the entire study population was 13.3 (SD: 1.7), with a range of 6.0 to 15.0, indicating a sufficient level of knowledge regarding COVID-19. In a similar way, the average practice score was determined to be 14.1 (SD: 1.4) with a range of 8.0 to 15.0.

Participants were also asked about their testing habits. Only 26.9% of the study population indicated that they had tested positive for COVID-19. Regarding the number of times that swab tests had been done, 49.1% had never done a swab test, while 50.9% had done it at least once. As much as 19.8% had done the test two or more times.

Attitude to Vaccination and Vaccines

Vaccine attitudes were another important component of the data collection. Using attitudes to the influenza vaccine as an indicator, 89.5% of

the nurses in this study took the influenza vaccine every year (Table III). When asked if they took the same vaccine this year, as much as 80.8% responded positively. Only 17.7% of the participants indicated that they decided at some point not to get a vaccination. Going further to probe about willingness to vaccinate if a COVID-19 vaccine was found, 70.7% indicated that they were willing to be vaccinated. In the same manner, 78.7% believe that COVID-19 vaccination should be mandatory once the vaccine becomes available.

Although the majority seemed to have a positive attitude towards the novel coronavirus vaccination, it was important analyze the reasons why 29.3% of the respondents decided to reject the vaccine. The most prevalent reason for COVID-19 vaccine hesitancy was the lack of enough knowledge, as 23.1% indicated that they did not know enough about the vaccine to accept being vaccinated with it (Figure 1). Similarly, 17.7% of the population

Table III. Participant’s attitudes to vaccines and vaccination (n = 334).

Variable	Values	Frequency	Percent
Takes the influenza vaccine annually	No	35	10.5%
	Yes	299	89.5%
Took the influenza vaccine this year	No	64	19.2%
	Yes	270	80.8%
Ever decided NOT to get a vaccination	No	275	82.3%
	Yes	59	17.7%
Willing to vaccinate if a COVID vaccine was found	No	98	29.3%
	Yes	236	70.7%
Do you think COVID-19 vaccination should be mandatory or not, once available?	No	71	21.3%
	Yes	263	78.7%

Knowledge score: mean (SD) – 13.3 (1.7), range: 6.0-15.0. Practice score: mean (SD): 14.1 (1.4), range: 8.0-15.0.

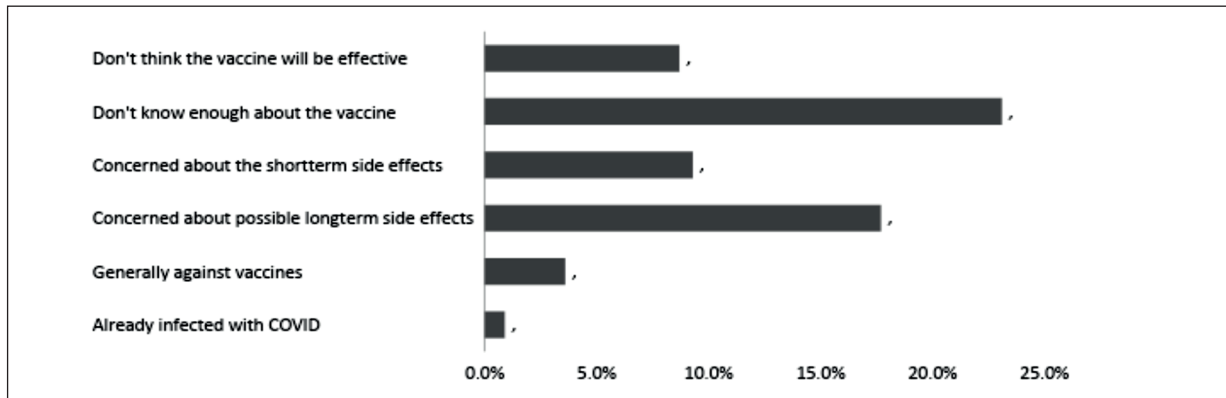


Figure 1. Participants’ reasons for unwillingness to receive the COVID-19 vaccine.

indicated that they were concerned about the possible long-term adverse effects which may reduce their willingness to accept the COVID-19 vaccine. Other important reasons as given by the participants include concerns about short-term adverse effects of the vaccine (9.3%), not thinking that the vaccine will be effective (8.7%) and being generally against vaccines (3.6%).

Relationship Between Knowledge and Practices Regarding COVID-19

As illustrated using the scatterplot (Figure 2), there appears to be a positive and strong relationship between knowledge scores and practice scores. With a Pearson correlation constant of 0.576 and a *p*-value of <0.001, participants

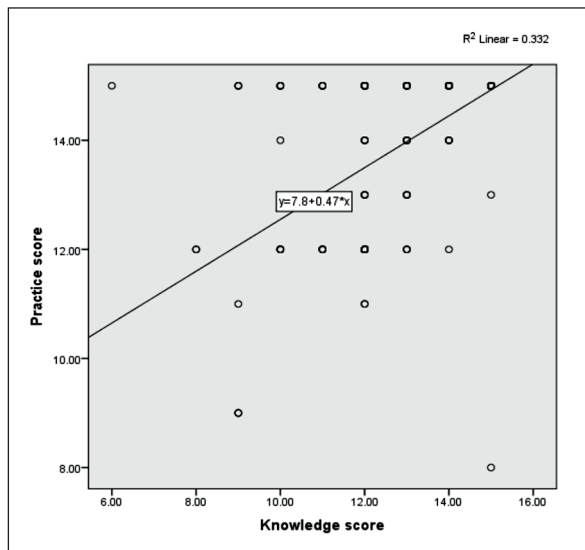


Figure 2. Scatterplot showing correlation between knowledge scores and practice score with Pearson correlation of 0.576 and a *p*-value of < 0.001.

who have higher knowledge scores are more likely to have higher practice scores and vice versa. This suggests a strong relation between COVID-19 knowledge and the application of preventive measures to prevent infections with COVID-19.

Relationship Between Socio-Demographic Factors and Vaccine Hesitancy

Using participants’ willingness to vaccinate as a measure of vaccine hesitancy/attitude, Table IV presents the results of tests of the association carried out to determine which of the socio-demographic factors significantly influence vaccine hesitancy. None of the socio-demographic factors tested had any statistically significant association with vaccine hesitancy (*p*-value > 0.05). However, certain categories of participants appear to be more inclined to accept and be vaccinated with the COVID-19 vaccine. A larger proportion of those 41 years or older (78.9%) were more likely to be willing to get vaccination than those 40 years or younger (69.0%, *p* > 0.05). Similarly, those who are non-Saudis (72.6% vs. 66.3% of Saudis), married (74.5% vs. 65.5% of those in single relationships), those without the chronic disease (72.4% vs. 62.9% of those with a chronic disease) are more likely to want to be vaccinated (*p*-value > 0.05).

Relationship Between Knowledge/Practices Regarding COVID-19 and Vaccine Hesitancy

This study also went further to determine if there were any relationships between each knowledge/practice and vaccine hesitancy. As seen in Table V, there were statistically significant differences in the average knowledge scores and

Table IV. Relationship between sociodemographic factors and willingness to be vaccinated with the COVID-19 vaccine (n = 334).

Variables	Willingness to vaccinate		χ^2	df	p-value
	No	Yes			
Age					
< 40 years	86 (31.0%)	191 (69.0%)	2.278	1	0.131
≥ 41 years	12 (21.1%)	45 (78.9%)			
Gender					0.878
Female	91 (29.4%)	218 (70.6%)	0.023	1	
Male	7 (28.0%)	18 (72.0%)			
Nationality					0.244
Non-Saudi	63 (27.4%)	167 (72.6%)	1.355	1	
Saudi	35 (33.7%)	69 (66.3%)			
Marital status					0.075
Single/widowed/divorced	49 (34.5%)	93 (65.5%)	3.179	1	
Married	49 (25.5%)	143 (74.5%)			
Department*					0.424
Low-risk	76 (67.9%)	36 (32.1%)	0.638	1	
High-risk	160 (72.1%)	62 (27.9%)			
Chronic disease					0.137
No	75 (27.6%)	197 (72.4%)	2.209	1	
Yes	23 (37.1%)	39 (62.9%)			
Years of experience					0.466
<10 years	68 (30.6%)	154 (69.4%)	0.531	1	
10 years or more	30 (26.8%)	82 (73.2%)			
Attended lectures about COVID-19					0.772
No	21 (28.0%)	54 (72.0%)	0.084	1	
Yes	77 (29.7%)	182 (70.3%)			
Encountered a confirmed COVID patient					0.054
No	22 (22.0%)	78 (78.0%)	3.711	1	
Yes	76 (32.5%)	158 (67.5%)			

*High-risk departments refer to emergency units, intensive care unit, operating room, and to in-patient care unit; while low-risk departments include administration, health education, outpatient departments, and primary health care.

practice scores. Participants with higher knowledge scores (13.5; SD 1.6) were more likely to be willing to be vaccinated with the COVID-19 vaccine ($p = 0.002$). Similarly, participants with higher practice scores were more willing to be vaccinated (14.3; SD 1.3) than those with relatively lower scores (p -value- 0.002). This implies evidence of a strong relationship between knowledge of COVID-19, practices related to COVID-19, and willingness to accept COVID-19 vaccines.

Discussion

To date, this is the first study assessing willingness and/or acceptance rates of COVID-19 vaccine uptakes and associated factors for hesitancy and attitudes toward COVID-19 vaccination among nurses in Saudi Arabia. We estimated nurses' knowledge about COVID-19, practices, and attitudes, intentions to vaccinate against COVID-19, and annual influenza vaccine uptake.

Table V. Unpaired t-tests between participant scores (on the knowledge and practice scales) and vaccine hesitancy (n = 334).

Variables	Willing to vaccinate if a COVID vaccine was found		T	df	p-value
	Yes	No			
Knowledge score	13.5 ± 1.6	12.9 ± 1.9	-3.181	332	0.002
Practice score	14.3 ± 1.3	13.8 ± 1.6	-3.148	332	0.002

Bolded p -values are significant at $p < 0.01$

Globally, most of the studies conducted during the COVID-19 pandemic about COVID-19 vaccine hesitancy included all health care workers. However, there were two studies^{11,16} in Hong Kong that investigated nurses' attitudes toward the COVID-19 vaccine. The nursing population may be at higher risk for respiratory infections like COVID-19 disease as they have more and longer contact time with the patients¹³. Moreover, nurses' intention to vaccinate against COVID-19 is less when compared to physicians¹⁰. Such variation was also observed in influenza vaccine uptake between physicians and nurses²⁰. A more recent study²¹ during the first month of COVID-19 vaccine rollout in Saudi Arabia showed only one-third of nurses either registered or received the vaccine while two-third of physicians received or registered for vaccination.

The results of our study indicate that more than two-thirds (70.7%) of the participants are willing to vaccinate once available. The findings of our study showed slightly higher rates of vaccine acceptance compared to other similar studies. For example, a study that included a nurses population conducted in Hong Kong during the COVID-19 outbreak reported 63% of nurses to have the intention to receive COVID-19 vaccine¹⁶. Another study¹¹ which was also conducted in Hong Kong showed fewer intentions to accept novel coronavirus vaccination, with only a 40% acceptance rate.

The higher rate of vaccine acceptance in our study could be attributed to the period of the data collection, which was during the last phase of the first wave just before final COVID-19 vaccine approval; such variation of vaccine acceptance rate over different periods of the pandemic was observed in studies²⁰. Also, the rate of COVID-19 vaccine receptivity in the current study is almost similar to the rate of vaccine acceptance among all health care workers when assessed in Saudi Arabia during a similar period²¹.

Regarding the public's vaccine acceptance rate, a study in Saudi Arabia showed that 64.72% were interested in receiving the COVID-19 vaccine when available²².

The previous inoculation by another vaccine-like influenza vaccine was observed as a strong factor to accept the COVID-19 vaccine in a study among nurses in Hong Kong¹¹ and another study in the United States²³ among the general population.

Interestingly, the acceptance rate of the COVID-19 vaccine is less than the uptake rates

of the influenza vaccine. Maybe it is the factor of the uncertainty of the effectiveness and the adverse effect of the novel COVID-19 vaccine as compared to the influenza vaccine. This component was clarified when the reasons for negative attitudes were investigated, which showed that inadequate information about the vaccine is one of the main reasons for refusal. This finding is in line with another study in the United States of 16,158 health care workers, which reported insufficient information as the main reason for vaccine hesitancy among employees' responses²².

Moreover, in this study, the second most observed reason for rejecting COVID 19 vaccine was long-term side effects; this was also reported among Maltese health care workers¹⁴.

Comparing our findings with the rate of acceptance among the public, the nurses' population in our study was more willing to vaccinate than the public. However, our study findings were consistent with a national study including all health care workers in Saudi Arabia regarding the acceptance of the COVID-19 vaccine¹⁹. Both studies showed two-thirds of respondents are accepting the COVID-19 vaccine once available. This is also found in other studies, which show higher acceptance rates among health care personnel compared to the general population¹⁵.

In regard to socio-demographic factors, the results of our study showed that the acceptance of the COVID-19 vaccine is not related to age, gender, marital status, nationality, years of experience, place of work, presence or absence of chronic disease, attending COVID-19 lectures and whether they encountered confirmed COVID-19 patients or not. This is contrary to findings of a systematic review of COVID-19 vaccine receptivity among health care workers, which showed more uptake of the vaccine among male gender, older age, fewer years of work experience, presence of chronic disease, and contact with confirmed COVID-19 patients¹⁰.

Other concerns stated by the participants were the effectiveness of the vaccine; this is also observed in similar studies assessing the acceptability of the COVID-19 vaccine among adults by Reiter et al²⁴. Another reason for hesitancy was a general anti-vaccine attitude which was also reported among health care personnel and the general population^{14,25}.

In more detail, other studies also showed that the age of health care workers is a factor in accepting the COVID-19 vaccine; this was observed by Grech et al¹⁴ in a study in Malta. In

a similar way, young age was a factor among nurses specifically for acceptance of COVID-19 vaccination¹⁶. In Greece, years of experience of health care professionals was reported as a factor before the outbreak period²⁶. Furthermore, encountering suspected or confirmed COVID-19 patients was observed as a factor in a similar study for acceptance of COVID-19 vaccination¹¹.

One of the findings in our study, about 90% of nurses, took the annual influenza vaccine during last year and less than that rate in the current season. This rate is higher than the rates of the previous study²⁷ among healthcare personnel conducted in eight main hospitals in Saudi Arabia, which was 67.6%. The results of a more recent study²⁹ during the early phase of the COVID-19 pandemic conducted in tertiary hospitals in Saudi Arabia assessing the uptake of influenza vaccine showed vaccine uptake is about two-thirds of health care workers. Similar to our study, the Hong Kong study¹¹ also reported a slight decline in influenza uptake rates for 2020 compared to 2019. However, the pandemic influence is unpredictable, as shown in Maltese health care worker's study¹⁴ where the uptake of influenza vaccine had increased significantly during 2020 compared to 2019.

In regard to nurses' knowledge and practice during the COVID-19 pandemic, our findings were consistent with a similar study²⁸ which showed high knowledge and practice of preventive measures among all health care workers and more significantly among nurses. Based on the results, we found a strong relationship between knowledge of COVID-19, practices related to COVID-19, and willingness to accept COVID-19 vaccines. Similarly, another study²⁹ reported high knowledge level was associated with the intention for COVID-19 vaccination acceptance among nursing students in seven European countries.

78.7% of nurses in this study think that COVID-19 vaccination should be mandatory, which may be considered as an effective strategy to increase vaccine receptivity among health care professionals who can transmit the infection to their patients. The mandatory strategies were considered as the most effective way to improve the vaccine uptake as found in evidence appraisal of influenza vaccination among health workers³⁰.

The study is not free of limitations; it is based on self-reported data, which is prone to recall bias and misclassification. Another limitation in this study is that we assessed the vaccination

acceptance at a time where there is no available vaccine. Also, the English language of the questionnaire may be misunderstood by Arabic nurses. However, we managed to be around the participants when filling the survey to overcome any confusion.

Conclusions

This study aimed to determine the level of COVID-19 vaccine acceptance among nurses, which was slightly higher than expected. To establish effective methods that may increase vaccine uptake, we investigated nurses' attitudes as well as their specific concerns. The main concern is inadequate information about the vaccine, long-term side effects, short-term side effects, and non-effective vaccines. There is a strong relationship between knowledge of COVID-19, practices related to COVID-19, and willingness to accept COVID-19 vaccines. Future studies may assess the uptake of the vaccine and compare it with the rates of vaccine acceptance during the period before the availability of a vaccine. The results of this study can help the policymakers to develop evidence-based strategies that may increase the vaccine uptake among nurses who are at a greater risk of catching and transmitting the infection.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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