



COVID-19 Vaccination Knowledge Among a Sample of Healthcare Providers in Karbala Governorate

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Abstract

Background: Although many vaccines are in development and clinical trials, and many vaccines have been distributed worldwide, the world has faced a huge challenge in line with the willingness to accept a COVID-19 vaccine in different countries. However, no study has been conducted on the knowledge and acceptance of the COVID-19 vaccine among HCPs in Iraq. Therefore. Health care providers, the frontline fighters, are at high risk of being infected with SARS-CoV- 2, many health workers in the world, have lost their lives in fighting with COVID-19 therefore, there is a more prominent need to evaluate their knowledge and factors influencing vaccination uptake among HCWs.

Materials and Methods: A descriptive; the cross-sectional study was performed at 4 hospitals and 18 PHCCs randomly selected (multistage sampling) in Karbala governorate. The period of data collection lasted 3 months, it began on 18th January 2022 ending on 12th April 2022. The study was conducted on 457 a sample of health care providers.

Result: knowledge score about general information of COVID-19 vaccine about 56.9 % of the sample with fair knowledge, and 37.0% with good knowledge, knowledge score about contraindication to COVID-19 which most of the samples (40.5%) had fair knowledge, whereas 35.2% of them with good knowledge, concerning knowledge score of Administration and types of COVID-19 vaccine, about 78.3% with fair knowledge, while 7.2% with good knowledge. knowledge score of side effects of the COVID-19 vaccine was about 39.9% with good knowledge, while 35.4 % of them had fair knowledge.

Conclusion: The study concluded that the highest proportion of the study sample had an acceptable score regarding knowledge and acceptance.

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Introduction

Coronavirus disease 2019 (COVID-19), an acute respiratory disease caused by the SARS CoV-2 virus, was first reported in Wuhan, China, in late 2019 (Shaikh et al., 2020). As of 22 December 2020, the COVID-19 pandemic was caused by over 76.2 million cases and over 1.6 million fatalities globally, the pandemic had a disastrous global impact, necessitating mitigating efforts to limit the epidemic (El-Elimat et al., 2021). In Iraq, the city of Najaf, south of Baghdad confirmed the first cases of COVID-19 in February 2020. After two weeks, the Iraqi Ministry of Health (MOH) announced that 101 cases have been tested positive for COVID-19 with nine deaths cases in fourteen provinces; almost 40% of those cases were in Baghdad. Then, the illness spread fast over the country as a result of human movements (Alsayed et al., 2022). In response to the 2020 COVID-19 pandemic, multiple vaccines were developed, tested through clinical trials, and presented to the FDA for Emergency Use Authorization (EUA), vaccines are one of the most dependable and cost-effective public health interventions ever developed, saving millions of lives each year (Ehreth, 2003). Many aspects are considered in the vaccine design, including the selection of SARS-CoV-2 antigens, the vaccine platform, and immunization regimens/routes. Vaccine platforms include live attenuated vaccine (LAV), inactivated virus vaccine, protein subunit vaccination, viral vector-based vaccine, and DNA or mRNA vaccine (Shin et al., 2020). As of February 18, 2021, WHO listed at least seven different vaccinations that have been distributed in many countries, with healthcare workers (HCWs)

being designated as the highest priority for vaccination. Furthermore, more than 200 other vaccines are now under development, with more than 60 of them in clinical trials (Huynh et al., 2020). Vaccines' production, storage, distribution, and administration may provide tremendous challenges, particularly in developing countries (Ghazi et al., 2021). As well given the emergence of new virus strains and vaccines with lower efficacy rates have also been distributed, higher rates of vaccination will be needed to achieve herd immunity (Elharake et al., 2021). Health workers, the frontline fighters, are at high risk of being infected with SARS-CoV-2, many health workers in the world, have lost their lives in fighting with COVID-19 (Abdel Wahed et al., 2020). Therefore, there is a more prominent need to evaluate the factors influencing vaccination uptake among HCWs (Elharake et al., 2021). The study aimed to determine the knowledge of the COVID-19 vaccine among healthcare providers who are frontliners in the war against the Covid-19 Pandemic

Subjects and Methods Study Design: The study is a descriptive cross-sectional study that was conducted in Karbala city at 22 hospitals and PHCCs that were randomly selected (multistage sampling). The duration of data collection lasted three months, The period of data collection lasted 3 months, it began on 18th January 2022 ending on 12th April 2022. The place of study was 4 hospitals, 4 health sectors and 18 primary health care sretneq in Karbala city. Inclusion criteria: health care providers randomly selected in health care centers



and hospitals in Karbala city. Exclusion criteria: healthcare workers out Karbala city and healthcare workers who does not have the desire or refuses to participate

Statistical data analysis

Analysis of data was carried out using the available statistical package of SPSS-28 (Statistical Packages for Social Sciences-version 28). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-

maximum values). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum). The significance of difference for different percentages (qualitative data) was tested using Pearson Chi-square test (χ^2 -test)with the application of Yate's correction whenever applicable. Statistical significance was considered whenever the P-value was equal to or less than 0.05.

Results

The general knowledge of healthcare providers (studied sample) about the covid-19 vaccine is revealed in a table (1). A high percentage of HCP had knowledge about COVID-19 vaccine development. (79.0 %) of them had correct knowledge about if the covid_19 vaccine prevents COVID_19 infection, and (84.5%) of HCPs answered correctly that the COVID-19 vaccine can reduce morbidity and mortality rate. While

(71.6%) answered correctly that COVID-19 never protects against influenza, The majority of answers (77.0%) were correct that must maintain social distancing after getting the COVID-19 vaccine, and also high percentage (86.4%) were answered correctly that must wear full PPE after getting the COVID-19 vaccine in COVID wards.

Table (1): Distribution of healthcare providers according to their knowledge about general information of COVID-19 vaccine

General knowledge	Yes		No		DNK	
	No	%	No	%	No	%
Recently?						
Pfizer	440	96.3	17	3.7		
AstraZeneca	358	78.3	99	21.7		
Sinopharm	411	89.9	46	10.1		
Vaccination prevents infection with COVID-19 disease (No)	77	16.8	361	79.0	19	4.2
COVID-19 vaccine reduces the morbidity and mortality rates of individuals	386	84.5	49	10.7	22	4.8
COVID-19 vaccine protects against influenza (No)	82	17.9	327	71.6	48	10.5
COVID-19 vaccine protects other people who do not receive a vaccine	140	30.6	270	59.1	47	10.3
COVID-19 vaccines protect against another species like MERS	235	51.4	179	39.2	43	9.4



Waiting to get immunity to COVID-19 virus naturally better than vaccination (No)	152	33.3	244	53.4	61	13.3
There is no scientific basis for taking aspirin or anticoagulant drugs with vaccine	169	37.0	137	30.0	151	33.0
Must maintain social distancing after getting COVID-19 vaccine	352	77.0	79	17.3	26	5.7
Must wear full PPE after getting the vaccine for COVID-19 in COVID wards	395	86.4	39	8.5	23	5.0
It is necessary to do a pregnancy test before taking a COVID-19 vaccine (No)	302	66.1	103	22.5	52	11.4

Table (2) shows the distribution of the sample according to their knowledge of the contraindication of COVID_19, (63.7%) of HCPs answered correctly that the COVID-19 vaccine is a contraindication for children under twelve years in Iraq, also (61.7%) answered correctly that the COVID_19 is a contraindication for pregnant women in the

first trimester. The highest percentage of the sample (74.2%) answered correctly that a person with active COVID-19 infection is contraindicated to the COVID-19 vaccine, (40.0%) of HPs answered do not know if the COVID-19 vaccine has been contraindicated to ITP

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Table (2): Distribution of healthcare providers according to their knowledge about contraindications and precautions of the COVID-19 vaccine

COVID-19 vaccine contraindication	Yes		No		DNK	
	No	%	No	%	No	%
Children less than 12 years	291	63.7	99	21.7	67	14.7
Pregnant women in the first trimester	282	61.7	101	22.1	74	16.2
Lactating mothers (No)	207	45.3	174	38.1	76	16.6
A person with an active COVID-19 infection	339	74.2	88	19.3	30	6.6
Patients had an immunocompromised disease (No)	267	58.4	114	24.9	76	16.6
Anyone who has other vaccines within the last 14 days	242	53.0	118	25.8	97	21.2
Patients had a severe allergic reaction to any product of vaccines	280	61.3	88	19.3	89	19.5
Patients have a severe infection with a high temperature of over 38°C	328	71.8	77	16.8	52	11.4
A person with a history of a condition known as thrombocytopenia and thrombosis are not contraindicated to COVID-19 vaccine	180	39.4	93	20.4	184	40.3

Table (3) shows the distribution of the sample according to their knowledge about the administration and type of the COVID-19 vaccine. About (85.1%) answered correctly that there are three doses of COVID-19 vaccine to complete vaccination, and a majority of the sample (91.7%)

answered correctly that must take precautions before administrating the COVID-19 vaccine, (84.5%) answered correctly regarding COVID-19 vaccines must not be mixed with other vaccines in the same syringe, while 84.2% answered wrongly that should get the same COVID-19



vaccine product for the subsequent doses in a two-dose vaccine series. A high percentage of answers (81.4%) were correct regarding reporting vaccine administration errors. Regarding the vaccine platform description of COVID-19 answers were correct as

follows: (51.4%) for some vaccines relied on mRNA technology, (40.5%) for the inactivated vaccines, (38.9%) for VLPs vaccine and (33.7%) for others like protein subunit, DNA and live attenuated vaccine.

Table (3): Distribution of healthcare providers according to their knowledge about the administration and type of the COVID-19 vaccine

Administration and type of COVID-19 vaccine	Yes		No		DNK	
	No	%	No	%	No	%
COVID-19 vaccines is given only intramuscularly (No)	293	64.1	144	31.5	20	4.4
There are 3 doses of the COVID-19 vaccine to complete a series of the vaccination in Iraq	389	85.1	43	9.4	25	5.5
One must take precautions like gloves and hand hygiene before administrating the COVID-19 vaccine	419	91.7	25	5.5	13	2.8
It is dangerous to use an overdose of COVID-19 vaccines (No)	305	66.7	56	12.3	96	21.0
It is dangerous to use more than 3 doses of the COVID-19 mRNA vaccine (No)	252	55.1	79	17.3	126	27.6
COVID-19 vaccines must not be mixed with other vaccines in the same syringe	386	84.5	31	6.8	40	8.8
One should get the same COVID-19 vaccine product for the subsequent doses in a two-dose vaccine series (No)	328	71.8	72	15.8	57	12.5
The third dose of the COVID-19 vaccine should be Pfizer or Moderna regardless of the type of vaccine that had been taken in the previous two doses	183	40.0	144	31.5	130	28.4
Time Interval between first and second dose at least 3 weeks in Iraq	377	82.5	36	7.9	44	9.6
Time interval between second and third dose at least 5 months in Iraq	232	50.8	116	25.4	109	23.9
Those recovering from corona can receive the COVID-19 vaccine after approximately 3 weeks	305	66.7	78	17.1	74	16.2
COVID-19 vaccines can be administrated with the flu vaccine on the same visit	89	19.5	224	49.0	144	31.5
Healthcare providers should report if COVID-19 vaccine administration errors	372	81.4	55	12.0	30	6.6
Some types of COVID-19 vaccines relied on mRNA technology like Pfizer	235	51.4	33	7.2	189	41.4
Some types of COVID-19 vaccines use inactivated coronavirus as the antigen like the Sinopharm vaccine	185	40.5	53	11.6	219	47.9
Some types of COVID-19 vaccines use used a modified version of a different virus (a vector virus) to deliver antigen to our cells like AstraZeneca	178	38.9	44	9.6	235	51.4
Other types of COVID-19 vaccines that are candidates by WHO contains a live attenuated	154	33.7	73	16.0	230	50.3

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virus, DNA of virus, protein subunit of COVID-19

Table (4) illustrates the distribution of the studied sample according to their knowledge about the side effects of the COVID-19 vaccine following immunization. The majority of HCPs (69.6%), (90.2%), (94.7%), (86.0%) and (88.0%) were answered correctly for hives, headache, high fever, redness and swelling at the site of injection and muscular pain respectively as

a side effect of COVID-19 vaccine, while (52.5%) were wrongly answered for consciousness or serious drowsiness, (70.5%) for swelling of the face or throat, (51.4%) for trouble in breathing or wheezing, (57.6%) for convulsions and (62,8%) for other serious reactions like numbness is not side effect to COVID-19 vaccine

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Table (4): Distribution of healthcare providers according to their knowledge about side effects following immunization of COVID-19 vaccine

Knowledge of side effects Following Immunization of COVID-19 vaccine	Yes		No		DNK	
	No	%	No	%	No	%
Hives	318	69.6	110	24.1	29	6.3
Headache	412	90.2	33	7.2	12	2.6
High fever	433	94.7	19	4.2	5	1.1
Redness and swelling at the site of injection	393	86.0	44	9.6	20	4.4
Muscular pain	402	88.0	38	8.3	17	3.7
Altered level of consciousness/Serious drowsiness	217	47.5	144	31.5	96	21.0
-Swelling of the face, throat, or mouth	135	29.5	217	47.5	105	23.0
Trouble breathing, hoarseness, or wheezing	222	48.6	146	31.9	89	19.5
-Convulsions or seizures	194	42.5	164	35.9	99	21.7
-Other serious reactions (e.g., "pins and needles" or numbness)	170	37.2	156	34.1	131	28.7

Table (5) shows the distribution of studied ample according to their knowledge of storage of the COVID-19 vaccine. 67.9% of them had correct knowledge about the sensitivity of the COVID-19 vaccine to light, whereas more than half of the participants

(52.3%), (56.2%), (55.8%) did not know about the shelf life of Pfizer, Sinopharm and AstraZeneca vaccines in a suitable temperature respectively, also (44.8%) did not know about transport the vialof COVID-19 vaccine at a suitable temperature.

Table (5): Distribution of healthcare providers according to their knowledge about cold chain of the COVID-19 vaccine

Knowledge of the cold chain of COVID-19 vaccine	Yes		No		DNK	
	No	%	No	%	No	%
COVID-19 vaccine sensitive to light	310	67.9	53	11.6	94	20.6
The shelf life of Pfizer is 6 months at -60 to -90 °C	165	36.1	53	11.6	239	52.3



Shelf life of Sinopharm is 24 months at 2-8 °C	156	34.1	44	9.6	257	56.2
The shelf life of AstraZeneca is 6 months at 2-8 °C	163	35.7	39	8.5	255	55.8
Transport the vial at 2 °C to 8 °C and not exceeding the total maximum storage during a day	190	41.6	62	13.6	205	44.8

The overall knowledge score is as follows:
 86.2% of HCPs had fair knowledge, 9.2% of them had good knowledge and 4.6% of them

had poor knowledge of the COVID-19 vaccine as shown in fig (1).

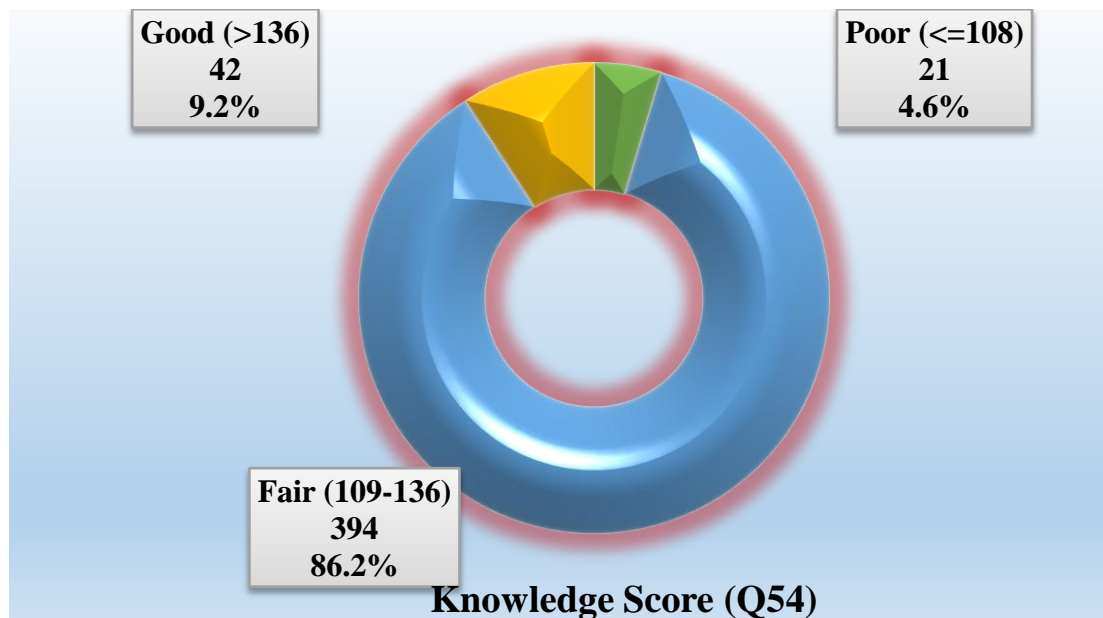


Fig (1): Overall knowledge score of COVID-19 among a sample of healthcare provide

Table (6) represented an association between knowledge of health care providers and their socio-demographic characteristics. that there was no significant association between knowledge of the study sample and some demographic characteristics except age, gender, educational level and duration of work (years) were significant at a P- the value of less than (0.05). Their age had a statistically significant association at (P = 0.048), this study had revealed the highest percentage of participants in the age group (20-29) years which were (52.4%) had good

knowledge, while their gender had a statistically significant association at a p-value (0.003), this study had shown the highest percentage of male (57.1%) had good knowledge. Also, related educational levels showed a significant relationship at (p = 0.049), that the highest percentage of participants (88.1%) had good knowledge as their level of education was at the college stage or higher. The duration of work (years) showed a significant association at (p = 0.001), where a high percentage of health care providers.

Socio-demographic characteristics		Knowledge Score (Q54)						P-value
		Poor (<=108)		Fair (109-136)		Good (>136)		
		No	%	No	%	No	%	
Age (years)	20---29	5	23.8	180	45.7	22	52.4	0.048*



	30---39	13	61.9	120	30.5	9	21.4	
	40---49	3	14.3	59	15.0	6	14.3	
	50---59	-	-	35	8.9	5	11.9	
Gender	Male	6	28.6	123	31.2	24	57.1	0.003*
	Female	15	71.4	271	68.8	18	42.9	
Educational level	Secondary	-	-	7	1.8	-	-	0.049*
	diploma	-	-	87	22.1	5	11.9	
	College & higher	21	100.0	300	76.1	37	88.1	
Marital status	Single	3	14.3	95	24.1	12	28.6	0.703
	Married	18	85.7	291	73.9	29	69.0	
	Divorced	-	-	8	2.0	1	2.4	
Residence	Rural	21	100.0	373	94.7	42	100.0	0.172
	Urban	-	-	21	5.3	-	-	
Qualification	Doctor	-	-	5	1.3	4	9.5	0.050
	Pharmacist	2	9.5	44	11.2	6	14.3	
	Dentist	-	-	14	3.6	-	-	
	Nurse	11	52.4	189	48.0	20	47.6	
	Technical	8	38.1	132	33.5	12	28.6	
	Administrator	-	-	10	2.5	-	-	
Duration of work (years) g	<10years	7	33.3	244	61.9	26	61.9	0.001*
	20---29	14	66.7	103	26.1	6	14.3	
	=>30years	-	-	47	11.9	10	23.8	
Have been infected with COVID-19 virus	Yes	16	76.2	300	76.1	33	78.6	0.940
	No	5	23.8	94	23.9	9	21.4	
Have immunization card	Yes	16	76.2	311	78.9	38	90.5	0.189
	No	5	23.8	83	21.1	4	9.5	
*Significant difference between percentages using Pearson Chi-square test (χ^2 -test) at 0.05 level.								

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Discussion

The highest proportion of HCPs knew about the COVID-19 vaccine development, in comparison with another study, this result is higher than reported in Ethiopia by (Abebe *et.al.*, 2021) who found 73.6% know about COVID-19 vaccine development, this difference may be due to that the study was conducted among the general population and conducted earlier in a period of the beginning of the availability of COVID-19 vaccine so that was no sufficient knowledge about COVID vaccine development. Besides COVID-19 vaccine

development, 79.0 % of HCPs was further had correct knowledge that vaccination doesn't prevent from getting COVID-19 infection and 84.5% of them answered correctly that vaccine reduces morbidity and mortality, this corresponding with a study conducted in Egypt by (Elgendy & Abdelrahim, 2021) found 86.5% of participant thought that they may get corona infection even they vaccinated, this is in contrast with a study conducted by (Al-Marshoudi *et.al.*, 2021) in Oman who found 52% of participant thought that vaccination



protects them from getting COVID-19 infection, this differences may be due to this study conducted among the general population. In our study 82.1% of HCPs answered incorrectly that they thought that the COVID-19 vaccine protected them from influenza, this corresponds with study conducted in Malaysia by (Mohamed *et.al.*, 2021) which demonstrated that 81.5% of participants answered wrongly or did not know. Regarding the question that the COVID-19 vaccine protects other people who don't receive the COVID-19 vaccine, 30.6% of HCPs answered correctly in comparison with the results of Mohamed *et.al.*, (2021) 42.5% of Malaysians answered correctly, Inadequate knowledge regarding vaccination can be due to low education background or obtaining information from their peer layman.

The obtained data demonstrated that half of the participants (53.4%) answered correctly that they never wait to get natural immunity from infection rather than the COVID-19 vaccine, this inconsistent with a study conducted in India by (Dara *et.al.*, 2021) who found only 29.9% of HCWs disagreed that COVID-19 infection is safer than vaccination. There is no significant difference in concepts in these studies, that suggest awareness and belief in the COVID-19 vaccine must be raised.

“There is no scientific basis for taking aspirin or anticoagulant medications with the COVID-19 vaccination” was answered by most of the HCPs (63%) wrongly or do not known, in contrast with study conducted in Egypt (Elgendy & Abdelrahim, 2021) which findings that

majority of participants (92.0%) answered correctly. This difference in results may not mean that awareness of the general public is higher than healthcare workers, the community of healthcare providers and their awareness about COVID-19 infection, they might see the importance of taking anticoagulants with the vaccine, due to the association of COVID disease with pulmonary thrombosis. In the present study, 77.0% and 86.4% of HCPs answered correctly that they must maintain social distance after getting the COVID-19 vaccine and must wear full PPE after getting the COVID-19 vaccine in COVID wards respectively, this is in line with a study conducted among HCWs in India by (Dara *et.al.*, 2021) who found 85.9% of participant thought " they must wear full PPE in COVID wards after getting COVID-19 vaccine, and 95.4% of them answered they must maintain social distance even they got COVID-19 vaccinated.

As presented earlier, 63.7% of the sample answered correctly about the COVID-19 vaccine is contraindicated to children less than 12 years, in comparison with another study, these findings higher than the study reported in Malaysia by (Mohamed *et.al.*, 2021) found 85.3% of participant answered incorrectly that they thought COVID-19 vaccine can be administrated to everyone regardless of their age, these differences may be due to differences target groups in this study that targeted general population. In the current study, 61.7% of the sample answered correctly that the COVID-19 vaccine is contraindicated to pregnant women in the



first trimester and 38.1% also answered correctly that the COVID-19 vaccine is not contraindicated to lactating women, and this results lower than the results found in Egypt by (Elgendy & Abdelrahim, 2021) who found that 89.0% of participants answered correctly that the pregnant women can get COVID-19 vaccine and 86.5% of Egyptian thought that lactating women are warned for COVID-19 vaccine. This difference in knowledge is related to various source of information that has been different from time to another.

To investigate whether COVID-19 vaccine is contraindicated to a person with active COVID-19 infection, 74.2% of HCPs answered correctly. In comparison with other studies, this study is higher than the study conducted in Oman by (Al-Marshoudi *et.al.*, 2021) where only 29.0% of participants answered correctly that it is not possible to give COVID-19 vaccine to a person suffering from active COVID-19, this differences may due to that the study of Al-Marshoudi conducted earlier whereas available information was limited about COVID-19 vaccine. And lower than the study reported in Egypt by (Elgendy & Abdelrahim, 2021) where 91.9% of participants answered correctly that the COVID-19 vaccine is contraindicated to a person with current infection with coronavirus, in the current study regarding the question that COVID-19 vaccine is contraindicated to the immunocompromised patient only 24.9% of HCPs answered correctly this slightly lower than study reported by (Kumari *et.al.*, 2021) in India were found 37.31% of participant

answered that immunocompromised patient is eligible to COVID-19 vaccine, Lack of knowledge about immunocompromised patients, perhaps due to public perception to vaccines that vaccines are contraindicated for immunocompromised patients and also the majority of cases decision-making is up to the doctor.

the present study demonstrated about 53.0% of HCPs answered correctly that Anyone who has other vaccines within the last 14 days is contraindicated, this finding is lower than that reported in Egypt by (Elgendy & Abdelrahim, 2021), who found that 91.5% of participants knew that one of the contraindications to getting the coronavirus vaccine is to have any other vaccination within the last 14 days. This suggests must increase knowledge regarding those who are eligible or not.

whereas about 61.3% of the sample answered that the COVID-19 vaccine is contraindicated to a person had previously severe allergic reaction to any product of vaccines, in contrasts the result conducted in India by who found only 37.8% of participants knew that persons with allergic are not eligible to the vaccine, while the study reported Ethiopia by (Abebe *et.al.*, 2021) who found 25.0% of participant thought that COVID-19 vaccine increase allergic reaction. These findings showed about 71.8% of the sample answered correctly that patients with severe infection and high temperature are contraindicated to the COVID-19 vaccine.

It was observed that the highest percentage of participants 85.1% answered



correctly that there are three doses to complete vaccination this is in contrast with a study conducted in Oman by (Al-Marshoudi *et.al.*, 2021) who found only 45% of participants answered correctly, this difference because of the current study is more recent and targeted healthcare providers. Whereas 91.7% of HCPs knew of one must take precautions like gloves and hand hygiene before administrating the COVID-19 vaccine, while in India, (Kumari *et.al.*, 2021) reported about 78.6% of respondents agreed to follow preventive measures after getting the COVID-19 vaccine.

Only 12.3% of HCPs answered correctly that it is not dangerous to use overdoses of COVID-19 vaccine, these findings are contrast with other studies conducted in Ethiopia by (Abebe *et.al.*, 2021) and the findings shown in Bangladesh by (Islam *et.al.*, 2021), they found more than half of participants answered that overdoses of COVID-19 vaccine were dangerous. The COVID-19 vaccine newly emerges, and the practical problems there are several types of COVID-19 vaccine and all of them are still in the clinical trial, so this difference in knowledge is due to the time of the study before the emergence of studies that prove the non-dangerousness of the overdose of COVID-19 vaccine-related with multiple vial doses like Pfizer and AstraZeneca. In the current study, the lack of knowledge is due to the lack of clear instructions regarding the vaccines. The present study was supported by (Raposo & Lippi, 2021) who found there are no major systemic side effects that could be recorded

after administration of vaccine overdose in VOR recipients.

About 17.3% of participants answered correctly there is no danger in using more than 3 doses of the COVID-19 mRNA vaccines, the correct results of the current study supported by some studies (Iacobucci, 2022) that found fourth doses of covid-19 mRNA vaccines are safe and provide a substantial boost to antibody concentrations and cellular immunity when given more than six months after the third dose of Pfizer's vaccine, and (Regev-Yochay *et.al.*, 2022) reported evidence data that the fourth dose of mRNA vaccine is immunogenic, safe, and somewhat efficacious (primarily against symptomatic disease) when given after four months of the third dose. And the results suggest that maximal immunogenicity of mRNA vaccines is achieved after three doses and that antibody levels can be restored by a fourth dose. (Munro *et.al.*, 2022) conducted a study in the United Kingdom and proven that fourth-dose COVID-19 mRNA booster vaccines are well tolerated and boost cellular and humoral immunity. Peak responses after the fourth dose were similar to, and possibly better than, peak responses after the third dose.

These data demonstrated that 66.7% was corrected answered about recovering from COVID-19 infection can receiving COVID-19 vaccine after three weeks, this result disagreed with a study conducted by (Elgendy & Abdelrahim, 2021), in the Egypt who found that 86.5% answered those recovering from COVID-19 infection can receive COVID-19 vaccine after



three months, the time interval between doses was altered from three months to three weeks according to new information of WHO.

In relation to the type of COVID-19 vaccines, 51.4% of HCPs answered that some types of COVID-19 vaccines relied on mRNA technology like Pfizer, 40.5% answered some types of COVID-19 vaccines used inactivated virus, while 38.9% of HCPs answered some type of COVID-19 vaccine used vector virus and 33.7% of them answered other types used live attenuated virus or DNA of virus or protein subunit of the virus. These results are in line with a study conducted among the general population in Malaysia by (Mohamed *et.al.*, 2021) found that 39.6% answered that some types of COVID-19 vaccine used inactivated virus while 37.5% of participants answered that some type of COVID-19 vaccine use genetic material from coronavirus.

knowledge about side effects of the COVID-19 vaccine, The result found a higher percentage of healthcare providers had good knowledge about the minor side effects of the COVID-19 vaccine that 69.6% of them answered correctly about hives, 90.2% about headache, 94.7% about high fever, 86.0% about redness and swelling at the site of injection and 88.0% about muscular pain. As regards, other major side effects of the COVID-19 vaccine lower percentage of healthcare providers answered correctly that 47.5% of HCPs answered correctly about consciousness as a side effect of the vaccine, 29.5% swelling in the face and throat, 48.6% about trouble breathing, 42.6% of them answered about

convulsions and 37.5% about numbness. These results are inconsistent with the previous studies that reported in Oman and Malaysia, cross-sectional study phone base conducted by (Al-Marshoudi *et.al.*, 2021) among Omanis found only 26% of participants knew minor side effects of the COVID-19 vaccine, as well as with result carried out among Malaysian by (Mohamed *et.al.*, 2021) about 75.4% of participants answered wrongly that the COVID-19 vaccine didn't have side effects. The difference in the target population, as well as, the difference in the study time may explain the variance in knowledge between the current study and the two previous studies mentioned above.

Furthermore, this finding was enhanced by a study of the prevalence of the COVID-19 vaccine side effect among healthcare workers in the Czech Republic conducted by (Riad *et.al.*, 2021) found that 89.8% of HCPs had injection site pain, 45.6% of them had a headache, 37.1% had muscular pain, 21.7% of them had a fever and 36.0% had blisters on the oral mouth, this may explain that almost correct answers of HCPs in the current study, that them-self experienced this side effects.

knowledge about the cold chain of COVID-19 vaccine. One of the most important variables in maintaining vaccine potency is effective management of the vaccine cold chain system at all levels. Due to increased temperature sensitivity and complicated vaccination regimens, vaccines have more complex handling and storage requirements. This urges adequate



knowledge, attitude, and practice (Mohammed *et.al.*, 2021).

Concerning knowledge about the cold chain of COVID-19 vaccine, 35.2% of HCPs had good knowledge and 35.2% of them had fair knowledge. About 36.1% answered that the Pfizer vaccine should be kept between -60°C to -90°C up to 6 months, 39.0% of them answered correctly that AstraZeneca should be stored between +2°C to +8 °C, while the shelf life of Sinopharm about 34,1% answered correctly that Sinopharm should be kept between +2°C to +8 °C. And 41.6% of HCPs answered that vial of Pfizer, AstraZeneca and Sinopharm when transported at +2°C to +8 °C not exceeded, these results are higher than results reported in the east Gojam zone in Ethiopia by (Bogale *et.al.*, 2019) which found 38.3% of healthcare workers had knowledge about the cold chain of all vaccines, and in line with a survey conducted in Cameroon by (Yakum *et.al.*, 2015) which found 71.7% of healthcare workers knew the temperature of EPI vaccines.

The total knowledge score of COVID-19 vaccine among healthcare providers, to date, there is no published article about the level of knowledge of the COVID-19 vaccine among healthcare providers in Iraq. This study revealed that 86.2% of participants had a level of acceptable knowledge of the COVID-19 vaccine and 9.2% with good knowledge, these results are similar to the results that had been reported in Libya among healthcare workers (Elhadi *et.al.*, 2021) which found the majority of the participant

had an adequate level of knowledge regarding COVID-19 vaccine, and consistent with the previous studies conducted among the general population in Malaysia, Oman, Ethiopia by (Mohamed *et.al.*, 2021; Al-Marshoudi *et.al.*, 2021; Abebe *et.al.*, 2021) respectively, which found they had an acceptable level of knowledge to word COVID-19 vaccine and in line with study reported in Iraq by (Taqi *et.al.*, 2021) which found acceptable knowledge of COVID-19 among health care workers. In contrast with previous studies conducted in Nigeria and China among healthcare providers and workers by (Ekwebene *et.al.*, 2021; Li *et.al.*, 2021) respectively, which found high knowledge among them. this difference may be because the COVID-19 vaccine is a global distributed and all international and local media concerned with main information far from extensive information about the vaccine.

This study showed an association between demographic characteristics and knowledge score. Lower age group, female, higher education level, and duration of work (years) were significantly associated with knowledge of the COVID-19 vaccine. In comparison these results with other studies, disagree with studies conducted in Libya and Nigeria by (Elhadi *et.al.*, 202; Ekwebene *et.al.*, 2021) respectively, which found there was no association between knowledge with the age and knowledge the gender while agreeing with the same studies regarding the educational level, that knowledge increased with higher education level. Related to years of work this study is consistent with the study conducted in



Cyprus by (Roupa *et.al.*, 2021), which found there was an association between knowledge and experience of years of work.

Conclusion

The largest proportion of the study sample had an acceptable score in relating to knowledge and Significant association was found between knowledge score and age, gender, educational level and duration of work (years).

More education and promotion are needed to assure healthcare providers that the vaccine is effective and safe. And needed to Correct some misconceptions among HCPs regarding a group of contraindicators of COVID-19 vaccine, types and cold chain of vaccines

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