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Knowledge, Attitudes, and Barriers Toward COVID-19 Vaccination Among Health-Care Workers in Nineveh Health Directorate, Iraq

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ABSTRACT

Background: The rapid dissemination of COVID-19 has highlighted the critical importance of vaccination to break the cycle of disease dissemination within the community. Vaccination protects both individuals and others from infection.
Objectives: To study the knowledge, attitudes, and barriersregarding COVID-19 vaccination among healthcare workers in health institutions in Nineveh governorate, Iraq.
Methods: A cross-sectional study was conducted among 1,296 health-care workers in the Nineveh Health Directorate over a six-month period. Data were collected using an electronic questionnaire consisting of three parts: (1) socio-demographic characteristics, (2) general information, and (3) attitudes toward COVID-19 vaccination. A three-point Likert scale was used, and the mean scores were calculated.
Result: The study revealed that 51.1% of participants were male, 45.2% had a university education, 69.3% were medical staff, and 54.6% were working in hospitals. Nearly half (46.9%) had 10 years or less of work experience, and the vast majority (86.6%) had been vaccinated. The grand mean score for general information was 2.5. Two-thirds of participants (61.1%) were vaccinated by Pfizer. The main reasons for refusing vaccination were fear of vaccine-related complications (67.8%) and the COVID-19-related death of a relative (58.7%). Conversely, the most common reason for accepting vaccination was direct contact with an infected person (71.8%).The grand mean score for attitude was 2.1. A significant association was found between greater work experience and higher knowledge regarding COVID-19 vaccination (P = 0.010).
Conclusion: Health-care workers in the Nineveh Health Directorate demonstrated good knowledge, positive attitudes, and high uptake of COVID-19 vaccination. However, targeted educational programs are needed to strengthen awareness among younger and less experienced staff.

Introduction

Coronavirus is a single-stranded RNA virus known as Coronaviridae [1]. Causing emerging acute respiratory infection with high morbidity, mortality rate and economic crises. [2][3]. The World Health Organization (WHO), 26 Feb. 2020, announced the outbreak of coronavirus [4]. The increasing spread of the disease causes fear and anxiety among healthcare providers, as the most vulnerable group contracting this new disease [5]. Rapid dissemination of the disease with little evidence on the effectiveness of potential therapeutic material, no pre-existing population's immunity toward it and a shortage of life-saving equipment in health institutions, resulting in the importance of vaccination to cut off the circle of disease dissemination in the community [6]. Vaccination plays an important role in preventing the likelihood of getting affected by COVID-19, and its consequences if immunity

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is developed through vaccination, it protects the person and others from being infected by the disease [7]. So that herd community vaccination plays an essential role in reducing infection rates and controlling the spread of the disease [8] WHO Guideline, 2021 and updated 2022 decline that vaccination was the only method to overcome and control getting infection. New emerging COVID-19 vaccinations are safe for children older than 5 years old, as the Pfizer vaccine with a dosage of 10 µg (0.2 ml), while the Moderna vaccine is safe for use in children aged 12 and older, with a dose of 0.5ml. WHO insist on vaccinating pregnant and breastfeeding baby to protect their baby via transmission of antibodies to them [9].

COVID-19 vaccines include five types (viral vector vaccines that contain engineered viruses to carry coronavirus genes, e.g., AstraZeneca. Genetic vaccines that deliver one or more of the coronavirus's own genes into cells to provoke an immune system e.g., Pfizer. Protein-based vaccines contain coronavirus protein but no genetic material, e.g., Novavax. Killed or inactivated vaccines created from weakened or killed coronavirus with a chemical, e.g., Sinopharm. Repurposed vaccines used for other diseases that may also protect against COVID-19 (not included) [9] [11]. Worldwide AstraZeneca vaccine is expected to be used as a routine vaccine against COVID-19, while types of vaccines approved by the Iraqi Ministry of Health and by the WHO for emergency use were Pfizer, AstraZeneca and Sinopharm [10]. These vaccines are given in two doses by the intramuscular injection at 90 degree in the deltoid muscle or in the thigh of a young child with a 2-3week interval [10]. The benefit of it is to reduce getting severe symptoms, recover more quickly if you catch COVID-19, reduce the risk of having to go to the hospital, dying from the disease and protect against different strains of COVID-19. Vaccines are the best method to prevent infectious diseases, and they save millions of people worldwide. At the same time, vaccines can cause side effects. Most of these are mild and short-term, and not everyone gets them. MHRA is responsible for continuously monitoring the safety of all medicines and vaccines via the use of the Yellow Card scheme [12]. Common side effects usually occur within 7 days of getting the vaccine, mostly mild and rarely affect a person's daily activities. These include (fever, chills, tiredness, and headache), which are more common after the second dose [13]. Severe allergic reactions to all vaccines are rare but can happen. Myocarditis and pericarditis associated with mRNA COVID-19 vaccination (AstraZeneca), mostly among males ages 12–39 years, can this be overcome by a longer interval between the first and second dose [14].

In spite of develop a safe and effective vaccine to highly contagious disease but hesitancy regarding their implementation was seen among health care providers [7].
Negative attitudes towards vaccines and the spread of misinformation about the ongoing pandemic can lead to vaccine take hesitancy, and that could be a serious problem for managing the COVID-19 pandemic [15]. Good knowledge can change attitude and improve practice [1].

Rationale: As a result of the spread of the virus and there cause of a very high morbidity rate with 2% mortality rate. Worldwide, the best health care system cannot overcome it and absorb the rapid spread of the disease in society, so an emerging new vaccine helps to decrease the burden by reaching herd immunity level vaccination.
Aim: To study knowledge, attitude and barrier to COVID-19 vaccination among health-care staff in health institution in Nineveh governorate.

Methods

The study was approved by the scientific ethical committee of Nineveh Health Directorate / MoH / Iraq by license number (220) in date 18 Aug. 2021, protocol research number 21/107 (Appendix I). A cross-sectional study was conducted over six months

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(January–August 2022) among healthcare workers (medical and non-medical personnel) from all health institutions in Nineveh Governorate. Participants of both sexes, all marital statuses, residences, educational levels, specialties, places of work, years of experience, and vaccination statuses were included if they agreed to participate. Health-care workers who declined participation were excluded. Stratifying the participants into medical and non-medical personnel, then a simple random sampling method was used from each stratum to include 1296 health care workers [898 medical workers (doctors, dentists, pharmacists, para-medical (nurses at all educational levels) and laboratory) and 398 non-medical (administrative, technician and engineering)]. Using an electronic data collection form via Google Drive form to distribute the questionnaire, a link was shared to WhatsApp and Facebook groups and shared personally as it was not feasible to conduct a population-based survey at this time because it required expensive resources such as time, money and manpower.

The questionnaire was developed based on the literature provided by the Public Health Directorate, Baghdad (2021) [17] Its validity was reviewed by consultants in Community Medicine and Internal Medicine at Mosul College of Medicine, University of Mosul, as well as by a consultant in the Public Health Department, Nineveh Health Directorate. The assessment covered relevance to participants, simplicity, and adequacy of subject coverage, yielding a validity index of 83%.

Reliability was assessed through pilot testing of the questionnaire. Most participants reported that the form was easy to read, and all confirmed that the instructions were clear. Reliability was further evaluated using the percent agreement method [18] based on participants' responses to general knowledge items on COVID-19 vaccination during test–retest examination.

The data collection form consists of three parts.

Part I: Socio-demographic characters

include age group in years (20-29, 30-39, 40-49, ≥ 50), sex (male, female), marital status (single, married and others), educational status (secondary, diploma, university and higher education), specialty medical includes (doctors, dentists, pharmacists, para medical, laboratory) and non-medical includes (administrative, technician and engineering), place of working (office center, hospital, specialist centers, sectors of Primary Health Care Centers System PHCCS, and Primary Health Care Centers PHCCs), years of work (≤ 10, 10- 19, ≥ 20) years, vaccination status (yes and no) and types of vaccine (Pfizer, Asterazenka and Sinopharm).

Part II: General Information and behavior toward COVID-19 vaccination

It consist from twelve items as follow: (The mechanism of action of the vaccine is to stimulate the immune system to recognize and fight viruses and germs that target the body, the main goal of the Covid-19 vaccine is to break the chain of infection and achieve community immunity, the time interval between the1st and 2nd dose of the vaccine is 3-4 weeks, the vaccine is given by intramuscular injection, types of vaccines approved by the Iraqi Ministry of Health (AstraZeneca, Pfizer and Sinopharm), the Covid-19 virus is made up of a strand (RNA) and a protein (SS), in addition to other proteins, side effect of vaccine includes (headache, muscle fatigue and pain, fever, Loss of consciousness due to fear and anaphylactic shock), sources of encouraging taking vaccination (health and medical personnel, the internet and social media, reading books and magazines, radio and television, relatives and friends and fear from getting sick or dying from the illness), getting COVID-19

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virus infection after vaccination, period of getting infection after vaccination (< Month, >Month) and reason for refusing taking the vaccine including eleven items (the danger of the vaccine and its complications, death or injury of a relative or friend after the vaccine, do not having health problem, so that there is no need to take the vaccine, it has no role in preventing the disease, fear of side effects of the vaccine, rumors about the vaccine, illness for any reason, I do not have enough information about the importance of the vaccine, crowding that occurs when taking the vaccine, I do not want and unavailability of the vaccine).

Part III- Attitude toward COVID-19 vaccinations

consists of seven items as follows: (the vaccine embarrasses me, taking the vaccine is of no benefit, I do not have a health problem, so there is no need to take the vaccine, in your opinion, the COVID-19 vaccines used in Iraq are safe? The vaccine procedure takes time. What to do if you get COVID after vaccination? (consult doctor, feel anxious and afraid, tell the family, use herbal and traditional therapy, go to a prayer house) and period of consultation if you get an infection with the COVID-19 virus after vaccination (within hours, within a week, within a month). (Appendix II)

Statistical analysis

The information regarding each participant was transferred into a code sheet, and data entry was done using a modern laptop. Statistical analysis, Excel version (16) and Minitab version (19) were considered. The data were presented in suitable tables and figures. Percentages were calculated for the various group variables.
Most answers of part II and part III are scaled according to a three-point Likert-scale as (yes, do not know and no), the mean score was calculated as follows:
(no. of participant said Yes × 3 + no. of participant said don't know ×2 + no. of participant said No × 1) / total no. of samples. The deviation of the score using the following formula: cut-off point (3+2+1)/3=2

The X^2 continuity test for a 2x2 table was used in comparing between two variables P-value ≤ 0.05 was considered significant throughout data analysis.

Result

Sociodemographic Characteristics of Study Sample:

The present study was conducted among health care workers, medical and non-medical workers. The total number was 1296 health workers for a 6-month duration.
Table 1 demonstrates the socio-demographic characteristics of participants, as 634 (48.9%) were male, 586 (45.2%) had a university education, more than two-thirds (69.3%) were medical staff, 707 (54.6%) were working in hospitals, 608 (46.9%) had working experiences for 10 years and less, 86.6% were vaccinated and commonest type of vaccine was Pfizer among participant it constitutes 797 (61.5%).

Table (1): Sociodemographic Characteristics of Study Sample.

Category	Total No.= 1296	%
Sex		
Male	634	48.9
Female	662	51.1
Age in years		
20-29	428	33.0

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30-39	426	32.9
40-49	286	22.1
≥ 50	**156**	12.0
Marital status		
Married	1012	78.1
Single	258	19.9
Others	26	2.0
Education level		
Secondary	214	16.5
Diploma	364	28.1
University	586	45.2
Higher education	132	10.2
Specialty		
1- Medical staff	898	69.3
1. Doctors, dentist, pharmacist.	526	40.4
2. Para medical	276	21.3
3. Laboratory	96	7.3
2-Non-medical staff	398	30.7
1. Administrative	260	20.6
2. Technician	90	6.8
3. Engineering	48	3.6
Place of work		
Hospital	707	54.6
Specialized center	205	15.8
Primary Health Care Center	347	26.8
Office Center	37	2.8
Years of work		
≤ 10 years	608	46.9
10- 19	408	31.5
≥ 20	280	21.6
Vaccination Status		
Yes	1122	86.6
Pfizer	797	61.5
Sinopharm	191	14.7
Asterazenka	134	10.4
No	**174**	**13.4**

General Information regarding COVID-19 vaccination:

The knowledge of participants regarding the COVID-19 vaccine is shown in Table 2. As 90.8% and 86.2% of participants know the mechanism of action of the vaccine and the main goal of it, respectively, more than three-fourths (mean percent 77.8%) of participants answered that vaccines approved by the Iraqi Ministry of Health, and the mean percent of knowing the side effects of the vaccine was 58.86%.

Table (2): Knowledge of participants regarding the COVID-19 vaccine

	General Information*	% of Yes	% of Don't know	% of No	Mean score	Grand mean score
1-	The mechanism of action of the vaccine is to stimulate the immune system to recognize and fight viruses and germs that target the body.	90.8	6.9	2.3	2.8	2.5
2-	The main goal of the Covid-19 vaccine is to break the chain of infection and achieve community immunity	86.2	7.2	6.6	2.7	
3-	The time interval between the1st and 2nd	84.5	5.9	9.6	2.7	

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	dose of the vaccine is 3-4 weeks				
4-	The vaccine is given by intramuscular injection	79.8	4.2	16.0	2.6
5-	Types of vaccines approved by the Iraqi Ministry of Health**				
	1. AstraZeneca	74.7	21.6	3.7	2.7
	2. Pfizer	86.6	11.7	1.7	2.8
	3. Sinopharm	72.3	22.8	4.9	2.6
	Mean percent	77.8	18.7	3.4	2.7
6-	The Covid-19 virus is made up of a strand (RNA) and a protein (SS), in addition to other proteins.	59.0	38.7	2.3	2.5
7-	Side effect of Vaccine**				
	1. Headache	78.3	10.5	11.2	2.6
	2. Muscle fatigue and pain	85.6	8.5	5.9	2.7
	3. Fever	80.4	9.4	10.2	2.7
	4. Loss of consciousness due to fear	26.3	25.8	47.9	1.7
	5. Anaphylactic shock	23.7	29.6	46.6	1.7
	Mean percent	58.86	16.6	24.2	2.2

***Total No. 1296** ** **Multiple Responses.**

That health and medical personnel were the primary source of encouragement for taking the vaccine, reported by 71.8% of participants. This was followed by the Internet and social media (45.9%), while 28.2% were encouraged through reading books and magazines. Radio and television accounted for 26.0% of the influence, and relatives and friends contributed to 17.3%. Interestingly, 16.4% of respondents stated that no one encouraged them; rather, their motivation came solely from fear of getting sick or dying from the disease. These results indicate that healthcare professionals and online platforms play a crucial role in shaping individuals' decisions regarding vaccination.

Table 3 shows that 297 (26.4%) got an infection with the COVID-19 virus after vaccination, and 116(39.1%) got an infection within a period of less than one month after vaccination.

Table (3): COVID-19 virus infection after vaccination

Categories*		Yes	
		No.	**%**
1-	**Getting COVID-19 virus infection after vaccination**	**297**	**26.4**
2-	**Period of getting the disease after vaccination**		
	< Month	**116**	**39.1**
	>Month	**181**	**60.9**

*** Total No. 1122**

The main reason for not taking the vaccine among refusers was concern about the vaccine's dangers and complications, which constituted 67.8%. The next most common reason was the death of a relative or friend after vaccination, followed by the belief that 'I do not have a health problem, so there is no need to take the vaccine, which constituted 58.6%. The unavailability of the vaccine was cited by 34.5% of respondents. In general, the grand mean score is 2.1, as shown in **Table 4**

Table (4): Reasons for refusing to take the vaccine

Categories	% of Yes	% of Don't know	% of No	Mean score	Grand mean score

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1-	The danger of the vaccine and its complications.	67.8	8.1	24.1	2.4	2.1
2-	Death of a relative or friend after the vaccine.	58.6	13.8	27.6	2.3	
3-	I do not have a health problem, so there is no need to take the vaccine.	58.6	16.1	25.3	2.3	
4-	It has no role in preventing the disease.	56.3	13.8	29.9	2.2	
5-	Fear of side effects of the vaccine.	56.3	10.3	33.4	2.2	
6-	Rumors about the vaccine	55.2	10.3	34.5	2.2	
7-	Illness for any reason	55.1	8.0	36.9	2.1	
8-	I do not have enough information about the importance of the vaccine	40.2	14.	44.9	1.9	
9-	The crowding that occurs when taking the vaccine	40.	12.7	47.1	1.9	
10-	I do not want	39.1	17.2	43.7	1.9	
11-	Unavailability of the vaccine	34.5	17.3	48.2	1.8	

*** Total No. 174 ** Multiple Responses**

Attitude toward COVID-19 vaccinations:

The percentage distribution of the study sample according to attitude toward COVID-19 vaccinations is shown in Table 5. The participants disagree with statements that the vaccine embarrasses them, that there is no benefit from it, and that there is no need for it if they do not have health problems, with 77.8%, 66.7%, and 63.2% disagreeing, respectively. More than four-fifths (87.5%) of the study sample agree to consult doctors, and 43.3% of them consult a doctor within hours or a week of experiencing COVID-19 symptoms after vaccination. The grand mean score for participants' attitudes toward COVID-19 vaccinations was 2.1.

Table (5): Percentage distribution of study sample according to attitude toward COVID – 19 vaccinations

Categories*		% of Yes	% of Don't know	% of No	Mean score	Grand mean score
1-	The vaccine embarrasses me**	11.8	10.4	77.8	2.6	2.1
2-	Taking the vaccine is of no benefit**	13.9	19.4	66.7	2.5	
3-	I do not have a health problem, so there is no need to take the vaccine**	19.2	17.6	63.2	2.4	
4-	In your opinion, the Covid-19 vaccines used in Iraq are safe?	57.7	26.5	15.8	2.4	
5-	The vaccine procedure takes time**	25.8	14.8	59.4	2.3	
6-	What to do if you get Covid after vaccination?					
	Consult doctor	87.5	6.8	5.7	2.8	
	feel anxious and afraid	33.4	16.3	50.3	1.8	
	Tell the family	72.4	10.5	17.1	2.5	
	Use herbal and traditional therapy	9.7	14.9	75.4	1.3	
	Go to prayer house	6.0	13.9	80.1	1.2	
	Mean percent	41.8	12.5	45.7	1.9	
7-	Period of consultation if you get infection with COVID-19 virus after vaccination.	No.	%			
	Within hours	562	43.3			
	Within week	567	44.5			
	Within a month	158	12.2			

***Total No. 1296, Multiple Responses **No is the correct answer**

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Association between certain demographic characters and general information of COVID -19 vaccination knowledge:

The association between participants' knowledge regarding COVID-19 vaccination with their educational level and specialty is shown in (Tables 6.a) and (Table 6.b). In general, it showed no wide differences between their knowledge with their educational level and specialties. P-value was statistically not significant, 0.115 and 0.61, respectively. At the same time, there are statistical differences in answers among participants between knowledge and years of work. P-value 0.010. This is seen in (Table 6.c).

Table (6.a): Association between knowledge and education level among study sample

	Category those who say yes	Secondary No. =(214)	Diploma No. =(364)	University No.= (586)	Higher education No.=(132)	Total	
		%	%	%	%	No.	%
1-	The Covid-19 virus is made up of a strand (RNA) and a protein (SS), in addition to other proteins.	42.0	56.5	60.0	87.8	764	59.0
2-	The mechanism of action of the vaccine is to stimulate the immune system to recognize and fight viruses and germs that target the body	82.2	89.0	93.5	96.9	1176	90.8
3-	Types of vaccines approved by the Iraqi Ministry of Health*						
	1. AstraZeneca	63.5	65.9	82.2	83.3	968	74.7
	2. Pfizer	78.5	83.5	91.4	86.3	1122	86.6
	3. Sinopharm	61.6	69.7	73.0	92.4	936	72.3
4-	The vaccine is given by intramuscular injection	71.0	78.5	82.2	86.3	1034	79.8
5-	The time interval between the1st and 2nd dose of the vaccine is 3-4 weeks	73.8	82.9	87.3	93.9	1096	84.5
6-	The main goal of the Covid-19 vaccine is to break the chain of infection and achieve community immunity	75.7	86.8	88.0	92.4	1116	86.2
7-	Side effect of Vaccine*						
	1. Headache	79.4	80.2	76.1	81.8	1016	78.3
	2. Muscle fatigue and pain	80.3	86.8	87.0	84.8	1110	85.6
	3. Fever	75.7	81.3	80.8	83.3	1042	80.4
	4. Loss of consciousness due to fear	31.7	24.7	24.5	28.7	340	26.3
	5. Anaphylactic shock	22.4	21.4	23.2	34.8	308	23.7

*** Multiple Responses. P-Value = 0.115**

Table (6.b): Percentage association between knowledge and specialty among study sample

	Category those who say yes*	Medical No.= (898)	Non-medical No. = (398)	Total	
		%	%	No.	%
1-	The Covid-19 virus is made up of a strand (RNA) and a protein (SS),	64.5	46.2	764	59.0

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	in addition to other proteins.				
2-	The mechanism of action of the vaccine is to stimulate the immune system to recognize and fight viruses and germs that target the body.	93.3	84.9	1176	90.8
3-	Types of vaccines approved by the Iraqi Ministry of Health*				
	1. AstraZeneca	76.6	70.3	968	74.7
	2. Pfizer	89.7	79.3	1122	86.6
	3. Sinopharm	75.7	64.3	936	72.3
4-	The vaccine is given by intramuscular injection	81.7	75.3	1034	79.8
5-	The time interval between the1st and 2nd dose of the vaccine is 3-4 weeks	87.9	76.8	1096	84.5
6-	The main goal of the Covid-19 vaccine is to break the chain of infection and achieve community immunity	88.8	79.8	1116	86.2
7-	Side effect of Vaccine*				
	1. Headache	82.4	69.3	1016	78.3
	2. Muscle fatigue and pain	90.4	74.8	1110	85.6
	3. Fever	82.8	74.8	1042	80.4
	4. Loss of consciousness due to fear	26.7	25.1	340	26.3
	5. Anaphylactic shock	25.6	19.5	308	23.7

*** Multiple Responses. P-value = 0.61**

Table (6.c): Percentage association between knowledge and years of working experiences among study sample

	Category those who say yes	**≤ 10 years No.= (608)**	**10- 19 years No.= (408)**	**≥ 20 years No.= (280)**	**Total**	
		%	**%**	**%**	**No.**	**%**
1-	The Covid-19 virus is made up of a strand (RNA) and a protein (SS), in addition to other proteins.	55.2	60.7	64.2	764	59.0
2-	The mechanism of action of the vaccine is to stimulate the immune system to recognize and fight viruses and germs that target the body.	91.7	87.7	92.8	1176	90.8
3-	Types of vaccines approved by the Iraqi Ministry of Health*					
	1. AstraZeneca	72.3	75.0	79.2	968	74.7
	2. Pfizer	88.4	83.4	87.1	1122	86.6
	3. Sinopharm	66.1	77.9	77.1	936	72.3
4-	The vaccine is given by intramuscular injection	80.9	77.4	80.7	1034	79.8
5-	The time interval between the1st and 2nd dose of the vaccine is 3-4 weeks	85.5	83.4	84.2	1096	84.5
6-	The main goal of the Covid-19 vaccine is to break the chain of infection and achieve community immunity	88.8	83.4	84.2	1116	86.2
7-	Side effect of Vaccine*					
	1. Headache	79.6	76.4	78.5	1016	78.3
	2. Muscle fatigue and pain	89.1	81.3	84.2	1110	85.6
	3. Fever	81.25	79.9	79.2	1042	80.4
	4. Loss of consciousness due to fear	22.6	25.4	35.0	340	26.3
	5. Anaphylactic shock	19.4	22.1	35.7	308	23.7

*** Multiple Responses. P-value = 0.010**

Discussion

An increased vaccination rate for COVID-19 results in faster control of the pandemic, return of normal activities, reduction in preventative measures, and reduction in transmission, morbidity, and mortality rates [19] WHO has identified vaccine hesitancy as one of the top 10

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threats to global health due to a lack of knowledge regarding COVID-19 vaccine acceptance, especially among health care workers (HCWs) [20].

The present study was conducted among health care workers in Ninevah health institution to study the knowledge, attitude, acceptance, and barriers to applying COVID-19 vaccination. It revealed that a nearly equal ratio between males and females, two-thirds of participants were young adults, three-fourths were married, more than two-thirds were medical staff, half of them worked in hospitals, and four-fifths were vaccinated against COVID-19.

The statistics of the Planning and Resources Development department in Ninevah Heath Directorate, 2019, revealed that the participation rate was 5.5% among the total number of health manpower, which was 23387, and the percentage of participation among health care workers was 11.0% as the total number of medical staff (doctors, dentists, pharmacists) was 4745. These findings nearly reveal the actual situation in Ninevah Health Directorate as the health compass of the planning department [21]. Male to female ratio was 1.1:1 and physician to para-medical ratio 1.5:1, respectively, according to the annual statistical report 2019 of the Iraqi Ministry of Health [22]. Most of the study sample consisted of young people and middle-aged adults because Iraqi law stipulated that an employee be referred to retirement at the age of 60 years, and the appointment of new graduates with medical, health, and technical specializations. [21] [22] Social, religious, economic and political factors play an important role in community structure, as early marriage is the real picture in the Islamic community [23].

The lack of central appointment for graduates of administrative colleges led to a small number of them compared to health and medical personnel. This is evidenced by the composition of the Nineveh health directors [21].

The level of education is closely linked to health, morbidity, and mortality, as those with more education have better health and lower mortality rates than those with less education. Education also influences a person to make health-related decisions. [24]A similar finding was seen in a 2023 Dubai study of 562 healthcare workers, which showed that three-quarters 432 (76.9%) of participants were female, more than one third 205 (36.4%) had less than 10 years of working experiences, one quarter 138 (24.6%) were physicians, 465 (82.7%) married and 228 (40.6%) middle age group [25]. Also, a Libyan study among 15,087 health care workers and population, 2021 showed a male to female ratio of 0.7:1, young adults with a mean age of 30.6±9.8 years [26]. Another group of 300 health care workers at Hedi Chaker University Hospital, Tunisia, 2023, were mainly females (74.3%) with a mean age of 29.5 ± 8.26 years. More than half of them (59.33%) are medical doctors.

According to work seniority, 243 participants (81%) had <10 years of work experience. One third of them were married (38.34%), and 254 (84.7%) had a high postgraduate degree [27].

Although the communicable disease unit of the Department of Health (DoH) implements widespread educational programs, the study found participants' knowledge and attitude levels to be only moderately high, with mean scores of 2.5 and 2.1, respectively.

A 2021 Libyan study used a convenience sample of 15,087 participants from the general population, healthcare workers, and medical students to assess acceptance of the COVID-19 vaccination. Although the participants had a good level of knowledge regarding COVID-19 vaccination, especially among medical health workers and students compared with the general population, 94.0% of them believed that the vaccine was effective to overcome the burden of disease, but 37.0% of the participants agreed that there were serious vaccine-related complications [26]. Similarly, a 2023 Egyptian study among 266 healthcare workers at Ashmoun General Hospital, Menoufia Governorate, concluded that the

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participants were very knowledgeable and had a positive attitude toward the COVID-19 vaccination [28].

Direct contact with infected patients with COVID-19 is considered a source of stress, anxiety, and fear among health care providers; therefore, the vaccine is the best solution to minimize transmission at work and lead to psychological reassurance. For this reason, continuous contact and regular training sessions play an important role in having good knowledge, a positive attitude, and a high level of acceptance of COVID-19 vaccination. This finding was seen in Tunisia in 2023 among 300 health care workers at Hedi Chaker University Hospital [27]. Unlike findings were seen in a study done among 310 Palestinian university employees in 2021. It revealed that less than half of the university employees had good knowledge, and half of them had a positive attitude towards the COVID-19 vaccination. In addition to the very low belief level of participants regarding vaccine safety [29]

The presence of comorbidity diseases and gender were predictors of low COVID-19 vaccination knowledge among 626 participants in Gondar City, Northwest Ethiopia, 2021. [30]

A positive attitude towards vaccine acceptance and efficacy was observed in the Libyan study in 2021 among 15,087 participants, with 12,006 (79.6%) agreeing to take the vaccine with an efficacy of 90% or more [26]. Another study involving 230 healthcare professionals in Jeeda, 2023, found that half of them held incorrect opinions regarding COVID-19 vaccination, yet 70% believed it could prevent them from contracting COVID-19, and only 5.7% believed that COVID-19 vaccination might alter their DNA [31].

A low level of attitude toward the COVID-19 vaccine, among 308 Egyptian healthcare workers, to study predictors of COVID-19 vaccine hesitancy, 2021, showed that only one-third of participants were strongly willing to vaccinate against COVID-19 despite the adequate insurance of COVID-19 vaccine safety, but they were widely hesitant or refused to be vaccinated. The study was conducted when COVID-19 vaccines were not yet introduced to HCWs in Egypt, and the actual introduction of the vaccine may alter the acceptance rate. At the same time, using a convenient sampling technique limits the generalizability of the study findings and might create selection bias [32].

Although negative attitudes toward COVID-19 vaccination existed, fear of disease was the most common reason for acceptance. This finding was reported among 455 healthcare workers in several hospitals in Egypt's Delta region in 2022 [33] and among 230 healthcare professionals in Jeddah in 2023 [31]. In a contrasting approach, the Italian health authority suspended 52 healthcare workers who had a negative attitude toward the vaccination in 2023 and initiated an educational program to improve acceptance [34].

A 2023 Dubai study of 562 healthcare workers showed that the barriers to taking the COVID-19 vaccine were as follows: among those reporting a barrier, 20 (10%) were generally against vaccines, 26 (13%) lacked time, 28 (14%) could not get an appointment, 48 (24%) believed a previous infection made vaccination unnecessary, and 78 (39%) had a contraindication [25]

The present study revealed that increasing years of working experience and specialty had a role in increasing the level of good knowledge and improving attitude toward COVID-19 vaccination. A similar finding was seen among 300 Tunisian health care workers in 2021, which showed that place of work and contact with COVID-19 infected patients, specialty, and increasing educational level had a good impression on a high level of knowledge and a positive attitude [27].

A 2023 Dubai study involving 562 participants found that being over 45 years old, working as a physician or nurse, being in contact with an infected person, having more than 20 years of work experience, and having a chronic illness were the most common factors influencing individuals to take and encourage others to take the vaccine [25].

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In contrast, a 2021 Libyan study found that vaccine acceptance was not associated with medical specialty or having a friend or family member who died due to COVID-19. However, acceptance was statistically associated with being in the 31–40 age group and having a family member or friend who tested positive for COVID-19. [26] In Egypt, a 2021 study indicated that higher income and more years of work experience were positive predictors of receiving a vaccine [32].

Similarly, a 2021 study from northwest Ethiopia concluded that marriage, education level, health education via mass media, and paternal primary education were significantly associated with positive knowledge about COVID-19 vaccination [30].

According to vaccine availability, Pfizer is the most popular vaccine among participants and was approved by the Iraqi Ministry of Health and the WHO for emergency use because it is safe, has fewer side effects, and is suitable for children aged 5 years and older, as well as for pregnant and breastfeeding mothers. (9, 13) This finding is supported by the Dubai Health Authority in 2023, which reported that 72.7% of participants received the Pfizer vaccine, followed by Sinopharm (23.8%) and AstraZeneca (3.6%). Additionally, 92.7% of participants agreed that COVID-19 vaccination is safe for family and friends to overcome the pandemic, with only 6.9% expressing doubt about the vaccine [25].

In the present study, the main sources of information were health personnel, the internet and social media, and friends. The primary motivation for seeking information was the fear of getting sick or dying from the disease.

The main sources of information for college students about the COVID-19 vaccine in northwest Ethiopia in 2021 (n=626) were health care providers and mass/social media; to a lesser extent, family and friends were also sources [30]. A similar finding was seen in a 2022 study among healthcare workers in northeastern Ethiopia, which showed that friends were the least common source of information [35].

Conclusion

The study found that most participants had good knowledge and positive attitudes toward COVID-19 vaccination, with four-fifths already vaccinated—Pfizer being the most commonly received vaccine. Greater work experience was linked to higher knowledge levels, and recommendations from medical personnel were the primary motivator for vaccination. The leading barrier was concern over vaccine safety and potential complications. Comprehensive educational programs are recommended, particularly for young, newly graduated, and less experienced healthcare workers, to enhance their ability to promote public trust in the safety and effectiveness of COVID-19 vaccines.

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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