Turk J Public Health
Available online at: http://dergipark.org.tr/tjph/
Doi: 10.20518/tjph.1549455

TURKISH JOURNAL OF PUBLIC HEALTH

ORIGINAL ARTICLE

Prevalence and underlying determinants related to COVID-19 vaccine hesitancy among Iraqi Healthcare professionals in Hilla City

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Received: 14.09.2024, **Accepted:** 30.03.2025

Abstract

Objective: This study aims to assess the prevalence of COVID-19 vaccine hesitancy among healthcare workers in Hilla City and understand the underlying reasons.

Method: A cross-sectional study was conducted at various health institutions in Al-Hilla City, randomly selected, from July 1, 2022, to November 1, 2022. A three-part questionnaire was used to collect information from all healthcare workers (HCWs) at these institutions who consented to participate. The first part was focused on socio-demographics. The second part gathered information on COVID-19 infection history and vaccination status. The third part used a five constraints scale questionnaire to evaluate the psychological factors affecting COVID-19 vaccine hesitancy among unvaccinated participants, which is composed of five main subscales: "confidence, complacency, constraints, calculation, and collective responsibility." Data were analyzed using the Statistical Package for the Social Sciences (SPSS) program.

Results: The study of 521 healthcare workers revealed a vaccine hesitancy rate of 12.5%, influenced by lack of confidence (86.2%), complacency (70%), and low collective responsibility (93.8%). Non-medical staff relying on social media for information were more likely to be hesitant ($p < 0.05$). Vaccine hesitancy was significantly associated with occupation, workplace, and information sources ($p < 0.05$) but showed no link to gender, marital status, education, or chronic disease history ($p > 0.05$).

Conclusion: The non-vaccinated participants were mostly non-medical healthcare workers employed in hospitals, with social media as their main source of information. Inadequate trust in the vaccine, a low sense of collective responsibility, and an underestimation of disease risk were key factors influencing vaccination decisions.

Keywords: COVID-19, Health Personnel, Vaccination Hesitancy, Vaccination Refusal, Vaccines

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Cite This Article: Al-mansoori RR, Abdullateef Alfadhul S. Prevalence and underlying determinants related to COVID-19 vaccine hesitancy among Iraqi Healthcare professionals in Hilla City. Turk J Public Health 2025;23(1): 94-105.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a serious, contagious disease that caused a worldwide outbreak [1]. The World Health Organization declared it a global health crisis [2].

It has been understood that vaccination is the most vital measure to control an epidemic. Vaccine development efforts began globally in January 2020 following China›s sharing of the virus›s genetic sequence [3].

The success of vaccination programs relies on people's preparedness to receive the vaccines. Due to their rapid development, concerns about the safety and effectiveness of new COVID-19 vaccines arose, contributing to vaccine hesitancy and complicating efforts to achieve widespread vaccination [4].

The COVID-19 vaccination program in Iraq began in early 2021, offering vaccines such as Pfizer-BioNTech, AstraZeneca, Sinopharm, and Sputnik V. Initially, healthcare workers and high-risk groups were prioritized. The program included two primary doses, with booster doses introduced in late 2021. Vaccines were distributed via hospitals and primary healthcare centers, and mandatory policies for healthcare workers were implemented by September 2021[5].

Healthcare workers (HCWs) were among the first groups recommended for COVID-19 vaccination by the World Health Organization [3]. The underlying reasons for this are the following. First, HCWs face a significantly greater danger of infection compared to the public, due to their interaction with patients during diagnosis and treatment. Corona viral test results showed that front-line HCWs have 11 times more positive rates than the general community [6].

Second, HCWs play a role in transmitting infections to patients through physicians' hands, equipment, and surrounding surfaces. Studies demonstrate that physicians can be a significant pathway for spreading hospital-acquired infections [7]. They can also spread the disease to their relatives, and others [8]. Therefore, healthcare workers are expected to be essential in achieving high vaccination rates and controlling the public health crisis [9]. The interaction between patients and healthcare workers (HCWs) is the basis for building public confidence in vaccines and addressing vaccine hesitancy [10]. Patients often have a strong trust relationship with their healthcare providers [11]. Effective communication from HCWs regarding vaccine benefits, risks, and importance empowers patients to make confident vaccination decisions. However, earlier studies have shown that a large percentage of HCWs are vaccine-hesitant in their personal lives, which may negatively affect their attitudes toward vaccines [12].

To increase Coronavirus disease 2019 vaccine rates among HCWs, their concerns about the vaccine must be addressed effectively. The causes of vaccine hesitancy have to be identified, and this information should be used to establish confidence in the vaccine. Therefore, the current study evaluates hesitancy toward the COVID-19 vaccine among Iraqi healthcare personnel and explores the reasons behind any vaccine hesitancy.

METHOD

A cross-sectional study was conducted at various health institutions in Al Hilla City. Using simple random sampling, three of five hospitals and three of twenty primary

healthcare centers were selected for the study. The total number of healthcare workers (HCWs) in these selected institutions, which formed the study's sampling frame, was 602 HCWs.

All healthcare workers employed at the selected institutions during the study period were invited to participate, regardless of shift timing. Those who were absent for extended periods (e.g., leave, travel) were not included. This included both medical staff providing direct clinical care (e.g., doctors, nurses, health officers, midwives, pharmacists, and medical laboratory technologists) and non-medical staff involved in non-clinical services (e.g., administrative employees, lawyers, accountants, cleaning staff, janitors, and others in non-clinical roles). Invitations were distributed through institutional announcements and direct communication.

The sample size was determined using the standard formula for survey studies: [$n = Z^2P\ (1–P)/d^2$], with a precision level of 0.05 and a 95% confidence interval. A previous study reported that 57.4% of healthcare workers were hesitant to receive a COVID-19 vaccine [13]. Based on this, the minimum required sample size was calculated as 376. However, to improve representativeness and strengthen statistical analysis, the sample size was increased to 521.

Among the 549 invited healthcare workers, 28 declined to participate, yielding a response rate of 94.9%.

Data were collected from July 1 to November 1, 2022, through interviews using a questionnaire adapted from previously published studies [14]. The questionnaire consisted of three sections. The first section gathered socio-demographic data. The second included questions related to COVID-19, such as family members who had previously contracted COVID-19 and sources of information on COVID-19 vaccination.

The third section focused on non-vaccinated HCWs, utilizing the translated, validated, and reliable Arabic form of the Five Constraints Scale (5C scale) to evaluate psychological factors influencing vaccine uptake[14]. This scale consists of 15 validated statements divided into five subscales: confidence, complacency, constraints, calculation, and collective responsibility.

The first subscale (Q1-Q3) measured confidence in vaccine effectiveness and safety, as well as trust in healthcare organization leaders and authorities.

The second subscale (Q4-Q6) assessed complacency, defined as the belief that vaccine-preventable diseases pose low risks and that vaccination is unnecessary.

The third subscale (Q7-Q9) explored constraints, such as limited access or personal concerns that might hinder vaccination.

The fourth subscale (Q10-Q12) evaluated calculation, reflecting an individual's effort to weigh infection risks against vaccination risks to make an informed decision.

The fifth subscale (Q13-Q15) assessed collective responsibility, focusing on the willingness to protect others through self-vaccination and contribute to herd immunity.

Non-vaccinated HCWs responded to three questions for each subscale on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). Neutral responses scored a 4, and reverse-coded items (marked R) were adjusted accordingly. The mean of these scores

was used to calculate subscale scores. The minimum required scores for the subscales were 5.7 for confidence, 4.7 for complacency, 6.0 for constraints, 6.3 for calculation, and 6.2 for collective responsibility.

A pilot study involving 20 HCWs was conducted to assess the questionnaire's clarity and completion time. While their feedback was used to improve the questionnaire, their data were excluded from the main study.

Participants were verbally informed about the study's purpose before the interviews. All collected information was kept confidential, and data were anonymized to protect participant identities. Ethical approval was obtained from the Babylon Governorate Health Directorate (Approval No. 78, dated 28/6/2022).

Data entry and analysis were performed using the Statistical Package for Social Sciences (SPSS) version 25. Categorical data were presented as numbers and percentages, while continuous data were described using means and standard deviations. The relationship between independent categorical variables was analyzed using the Chi-square test or Fisher's exact test. Mean differences were compared using the independent samples t-test. Statistical significance was set at a p-value of 0.05 or lower.

RESULTS

The present study included 521 healthcare workers. Their mean age was 33.2 years, with a standard deviation (SD) of 10.3 years. A total of 48.2% were in the age group of less than 30 years, and about two-thirds were females (67.0%). The majority were married (64.7%), most of them lived in urban areas (82.7%), and 72.4% of the participants worked in a hospital, as shown in [Table 1].

Table 1. Sociodemographic characteristics of participants (n = 521)

Characteristic		**n**	**%**	**Mean ± SD**
Age (years)				33.2±10.33
Age groups (years)	<30	251	48.2	
	30-40	146	28.0	
	41-50	63	12.1	
	51-60	54	10.4	
	61-70	7	1.3	
Gender	Male	172	33.0	
	Female	349	67.0	
Marital status	Married	337	64.7	
	Single	167	32.1	
	Separated or Widow	17	3.2	
Residence	Urban	431	82.7	
	Rural	90	17.3	
Workplace	Hospital	377	72.4	
	PHCC	144	27.6	
Occupation	Medical HCWs: doctor, nurse, Midwives, Pharmacists and other	411	78.9	
	Non-medical HCWs administrative employees, accountants, cleaning staff, and others	110	21.1	
Years of experience of participants				8.89 ± 9.53

Table 1. (Continued) Sociodemographic characteristics of participants (n = 521)			
Years of experience groups (years)	< 5	234	44.9
	6-10	146	28.0
	11-15	42	8.1
	16-20	18	3.5
	>20	81	15.5
Educational level of participants	Illiterate	3	0.6
	Read and write	6	1.2
	Primary School	12	2.3
	Intermediate School	16	3.1
	Secondary High School	66	12.7
	Institute	168	32.2
	College	223	42.8
	Higher Education	27	5.2
Total		521	100

The majority of participants (87.5%) had no history of chronic diseases; more than half of the participants (51.3%) had a previous personal history of COVID-19, and 62.8% had a family history of COVID-19, as shown in [Table 2].

Table 2. Distribution of participant according to their history of chronic disease and COVID-19 infection and vaccination

Characteristic		**n**	**%**
Chronic diseases	No chronic disease	456	87.5
	Single disease	54	10.4
	Multiple diseases	11	2.1
Personal history of COVID-19 disease	Yes	267	51.3
	No	197	37.8
	Not sure	57	10.9
Family history of COVID-19 infection	Yes	327	62.8
	No	164	31.5
	Not sure	30	5.7
COVID-19 vaccination status	Vaccinated	456	87.5
	Non vaccinated	65	12.5
Total		521	100.0

Of the total number of non-vaccinated HCWs (65), 56 (86.2%) did not have confidence in the effectiveness and safety of vaccines, the vaccine delivery system, and the policymakers. Additionally, 30 (46.2%) of non-vaccinated HCWs reported complacency, which is a perception of low disease risk and no need for vaccination. Six (9.2%) had constraints against vaccination, 39 (60%) did not calculate to weigh the risk of infection versus the risk of vaccination, and 61 (93.8%) did not have collective responsibility for protecting others through self-vaccination or did not know enough about herd immunity, as shown in [Figure 1].

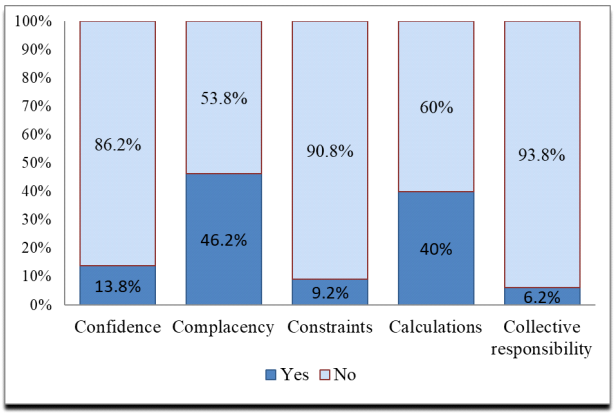

Figure 1. Distribution of non-vaccinated HCWs according to the Five Constraints Scale of COVID-19 vaccine hesitancy

Table 3 compares the socio-demographic characteristics of HCWs based on their COVID-19 vaccination status. Non-vaccinated HCWs were more likely to work in hospitals (93.8%) compared to vaccinated HCWs (69.3%), a statistically significant difference ($p < 0.001$). Additionally, a higher proportion of non-vaccinated HCWs were non-medical staff (32.3%) compared to vaccinated HCWs (19.1%) ($p = 0.021$). While non-vaccinated HCWs were slightly younger and more likely to be female, these differences were not statistically significant ($p > 0.05$). Similarly, there was no significant association between vaccination status and marital status, residence, educational level, or years of experience ($p > 0.05$).

Table 3. Distributions of Socio-demographic factors among participants according to their COVID-19 vaccine status

Variable		Receiving the COVID vaccine						p-value
		COVID-19 vaccine recipients		COVID-19 vaccine non-recipients		Total		
		n	%	n	%	n	%	
Age groups (Years)	<30	215	47.1	36	55.4	251	48.2	0.174
	31-40	129	28.3	17	26.2	146	28	
	41-50	53	11.6	10	15.4	63	12.1	
	51-60	52	11.4	2	3.1	54	10.4	
	61-70	7	1.5	0	0	7	1.3	
Age (years) Mean ± SD		33.51± 10.56		31.08±8.30		33.2±10.33		0.076
Gender	Male	149	32.7	23	35.4	172	33.0	0.664
	Female	307	67.3	42	64.6	349	67.0	
Marital status	Married	299	65.6	38	58.5	337	64.7	0.441
	Single	141	30.9	26	40	167	32.1	
	Separated and Widow	16	3.5	1	1.5	17	3.3	
Residence	Urban	381	83.6	50	76.9	431	82.7	0. 186
	Rural	75	16.4	15	23.1	90	17.3	
Occupation	Medical	369	80.9	44	67.7	413	79.3	0.013
	Non-medical	87	19.1	21	32.3	108	20.7	
Educational level	Illiterate	2	0.4	1	1.5	3	0.6	0.107
	Read and write	5	1.1	1	1.5	6	1.2	
	Primary School	8	1.8	4	6.2	12	12.3	
	Intermediate School	15	3.3	1	1.5	16	3.1	
	Secondary High School	63	13.8	3	4.6	66	12.7	
	Diploma (Institute)	149	32.7	19	29.2	168	32.2	
	Collage	190	41.7	33	50.8	223	42.8	
	Higher Education	24	5.3	3	4.6	27	5.2	
Workplace	Hospital	316	69.3	61	93.8	377	72.4	<0.001
	PHCC	140	30.7	4	6.2	144	27.6	
Years of experience	< 5	199	43.6	35	53.8	234	44.9	0.422
	5-10	129	28.3	17	26.2	146	28	
	11-15	39	8.6	3	4.6	42	8.1	
	16-20	15	3.3	3	4.6	18	3.5	
	> 20	74	16.2	7	10.8	81	15.5	
Total N		456	100.0	65	100.0	521	100.0	

A negative history of chronic disease among vaccinated HCWs was (88.2%), while in non-vaccinated HCWs it was (83.1%), the statistical analysis showed no significant association ($p > 0.05$). The history of COVID-19 disease in non-vaccinated participants was (52.3%) while in vaccinated participants it was

(51.1%), the statistical analysis showed no statistically significant association (p > 0.05). The family history of COVID-19 disease in non-vaccinated participants was (64.6%) while in vaccinated participants it was (62.5%), the statistical analysis showing no statistically significant association (p > 0.05), as shown in [Table 4].

Table 4. Distribution of participants according to the history of chronic disease, and personal and family history of COVID-19 disease concerning their vaccination status

Variable	Receiving COVID vaccine						p-value
		COVID-19 vaccine recipients		COVID-19 vaccine non-recipients		Total	
		n	%	n	%	n	%	
Chronic disease	none	402	88.2	54	83.1	456	87.5	0.576
	Single disease	45	9.9	9	13.8	54	10.4	
	Multiple diseases	9	2	2	3.1	11	2.1	
COVID infection history	Yes	233	51.1	34	52.3	267	51.2	0.673
	No	171	37.5	26	40	197	37.8	
	Not sure	52	11.4	5	7.7	57	10.9	
Family member's history of COVID -19 infection	Yes	285	62.5	42	64.6	327	62.8	0.951
	No	145	31.8	19	29.2	164	31.5	
	Not sure	26	5.7	4	6.2	30	5.8	
Total		456	100	65	100	521	100	

The findings in [Table 5] showed a statistically significant association between vaccination and the main source of information among the participants (p-value = 0.004), with the highest proportion of vaccinated individuals. (55.7%) cited doctors and other HCWs as the main source of information, while social media platforms and YouTube were the main sources for the highest percentage of non-vaccinated HCWs (46.2%)

Table 5. Distribution of participants according to the source of information about the COVID-19 vaccine concerning their vaccine status

The main source of information about COVID-19 vaccination	Receiving COVID vaccine				Total		p-value
	COVID-19 vaccine recipients		COVID-19 vaccine non-recipients				
	n	%	n	%	n	%	
Doctors/HCWs	254	55.7	21	32.3	275	52.8	0.004
TV /newspapers /news releases	44	9.6	9	13.8	53	10.2	
Social media platforms /YouTube	118	25.9	30	46.2	148	28.4	
Scientists/scientific journals/ conferences	34	7.5	4	6.2	38	7.3	
People around them	3	0.7	1	1.5	4	0.8	
No source	3	0.7	0	0.0	3	0.6	
Total n (%)	456	100	65	100	521	100	

DISCUSSION

This study found that 12.5% of HCWs were hesitant to receive the COVID-19 vaccine. The main reasons for hesitancy included a lack of confidence (86.2%), low collective responsibility (93.8%), and complacency (70%). Vaccine hesitancy was significantly associated with occupation, workplace, and information sources (p < 0.05) but not with gender, marital status, education, or chronic

disease history. These findings highlight the critical need for targeted interventions, especially among non-medical HCWs who rely on social media for vaccine information. Compared to previous studies in the region, our findings indicate a higher vaccine acceptance rate is higher than that reported in regional and global studies conducted among healthcare workers before the introduction of the vaccine, such as in Kurdistan (72.1%) [15], Kuwait (83.3%) [16], Saudi Arabia (64.9%, 64.4%) [17, 18], Oman (40%) [19], and Egypt (48% among medical students) [20]. These differences in acceptance rates before and after the vaccine introduction could be because the willingness to get vaccinated does not necessarily mean that individuals will do so. These decisions are complex, influenced by many factors, and can change over time [21].

In studies among the general population in Iraq, the acceptance rate was 77.6% and 61.7% [22, 23]. Vaccination acceptance was higher among healthcare workers compared to the general population. Three main reasons explain this: the higher medical knowledge of HCWs, their concern about catching COVID-19 from patients, and their worry about spreading the infection to their families. A study found that healthcare workers were at high risk of contracting COVID-19, which worried them due to the potential of spreading the infection to their families [24]. Lastly, the Iraqi government's mandatory vaccination policy for healthcare workers, implemented in September 2021, played a significant role [25].

Current results showed no association between the vaccination status of HCWs and their sex ($p > 0.05$). This is similar to what was found in studies conducted in Iraqi Kurdistan [13, 26], Baghdad [27], and the general population in Iraq [22]. Many studies have found that males had a higher vaccination acceptance rate than females, as observed in studies on healthcare workers in Iraqi Kurdistan [15] and Saudi Arabia [17]. In contrast, one study reported higher acceptance among females [28]. This could be explained by the fact that most of the current participants (67%) were female, so no clear relationship could be determined. Alternatively, it may be based on a recent study showing that female healthcare workers were infected more often than male ones, while male healthcare workers had higher mortality rates than female healthcare workers [29].

This study did not find significant differences in vaccination rates between different age groups ($p > 0.05$). Researchers reported higher vaccination rates among younger HCWs [30]. In contrast, others who were older were more likely to receive the vaccine [31]. There is no clear explanation for this discrepancy. Social media exposure and misinformation might make younger healthcare workers less likely to get vaccinated, while the higher risk of serious illness for older healthcare workers encourages them to get the vaccine. Conversely, older HCWs could be more concerned about potential vaccine side effects and less involved in COVID-19 patient care.

The non-medical HCWs were more cautious about accepting the COVID-19 vaccine than medical HCWs. This is also reported by other studies [13, 19], as medical health workers are at a higher risk of contracting infections, are more likely to be aware of the risks associated with infectious diseases [32], and have a greater understanding of the significance of vaccines in preventing the transmission of such diseases.

Regarding the workplace, in our study, vaccine

hesitancy was higher among hospital workers than PHCC workers. As a consequence of direct contact with COVID-19, HCWs might become less concerned about the virus, leading to a decreased perception of personal risk. Additionally, since the PHCC is smaller and has fewer employees, it is easier to request that employees bring their vaccination card or a negative (PCR) test weekly for those who are not vaccinated. In Iraq, unvaccinated employees are required to provide a verified negative test at their workplaces every week [25]. In contrast, hospitals have many employees and large facilities, making it more challenging to monitor each employee. There has been controversy over a Kurdistan study [15]. According to this study, PHCC workers are more cautious about vaccines than hospital workers. This may be because the study was conducted shortly before the local availability of the vaccine.

Our study showed no relation between educational level and vaccination status, which is consistent with an earlier study [27]. Other studies conducted among the general public found that higher vaccine acceptance is more common among individuals with higher education levels [22, 33]. The reason for this might be that healthcare workers have higher education levels than the general population.

Current findings show that comorbidities were not related to vaccination, similar to the findings of other researchers [3, 26]. In contrast, previous research found that comorbidities increased the likelihood of vaccine acceptance [34,35]. In other studies, HCWs with comorbidities showed more hesitancy toward vaccines, which could be associated with fears of adverse effects [36]. These differences from the present study could be because most of the current respondents were young and did not have chronic conditions.

Misinformation about COVID-19 and vaccines is a potential determinant associated with vaccine hesitancy. Among the vaccinated (55.7%), doctors and other healthcare workers were the main sources of information, while social media platforms and YouTube were the primary sources for non-vaccinated HCWs. The association was highly significant ($p = 0.004$). Our results are comparable to those of others [23, 27]. The role of social networks in shaping public attitudes toward COVID-19 vaccines has been investigated in several studies [28].

Among the Five Constraints Scale, the highest percentage in the present study was due to a lack of collective responsibility. This suggests that 93.8% of non-vaccinated HCWs did not feel a sense of social responsibility to protect others by vaccinating themselves and contributing to herd immunity[37]. Collective responsibility has been associated with increased vaccine acceptance in previous studies [38,39]. Similarly, **59.6%** of participants in a survey across 13 Arab countries, including Iraq, lacked collective responsibility [40].

The second-highest percentage of non-vaccinated HCWs (86.2%) in our sample lacked confidence in public health authorities, vaccine safety, and the effectiveness of the vaccine. This concern has been reported in other studies [14,36].

Complacency was the third determinant, with 46.2% believing their immune system was sufficient, reducing their intention to vaccinate. This belief affects their intention to get vaccinated and has been reported in other studies [41].

Calculation, or weighing risks and benefits, was observed in 40% of non-vaccinated HCWs, potentially exposing them to misinformation and lowering vaccine uptake [16,38]. It is possible that individuals who extensively searched for information were exposed to misinformation, reducing their willingness to get vaccinated.

Lastly, only 9.2% reported constraints, suggesting that access to vaccination was not a significant concern. Earlier studies showed that greater constraints were associated with lower vaccine intake [13,16].

The limitations of this study include the geographically homogeneous sample from Al Hilla City, which limits generalizability, and its focus on non-vaccinated HCWs, which prevents comparisons with vaccinated counterparts. Additionally, the survey was conducted early in the vaccine rollout, providing only a snapshot of HCWs' attitudes. Several potential biases may have influenced the study findings. Response bias may have occurred as participants with strong vaccination opinions were more likely to respond. Recall bias is also a concern since self-reported data on infection history and vaccination status may be inaccurate. Additionally, information bias could result from self-assessments, leading to potential misclassification errors in evaluating vaccine hesitancy. However, to our knowledge, this is the first Al-Hilla study to use the validated and translated 5C tool to assess COVID-19 vaccine hesitancy, with a good sample size drawn from both primary and secondary health institutions.

CONCLUSION

In this study, 12.5% of healthcare workers hesitated about COVID-19 vaccination (delay or refusal). Non-medical staff working in hospitals were likelier to be unvaccinated and relied heavily on social media for information. Complacency, lack of collective responsibility, and confidence about COVID-19 are the major determinants of vaccine hesitancy. There are no available constraints for vaccination among most non-vaccinated healthcare workers. Based on study findings, vaccination of healthcare workers needs to be addressed by providing more training and education regarding COVID-19 disease, vaccine, and herd immunity to increase their trust in policymakers, safety, and effectiveness of vaccines, with a concentration on non-medical healthcare workers and those working in the hospital.

ACKNOWLEDGEMENT

Conflict of Interest: No conflict of interest.

Financial Support: None.

Ethical Declaration: Participants were verbally informed about the study's purpose before answering interview questions. All collected information from participants was kept confidential. Data was collected anonymously, meaning participants were not identifiable. The study received approvals from the Babylon Governorate health directorate (No.78 on 28/6/2022).

Author Contrubition: Dr. Rasha Raheem Al-mansoori contributed to data collection, manuscript preparation, and literature reviewing. Professor Shaymaa Abdullateef Alfadhul contributed to the study design, statistical analyses, and interpretation of data.

Author Contribution: Concept: SA, Design: SA, Writing: RRA Data collection: RRA, Data analysis: RRA, SA Revising the manuscript critically: RRA, SA Final approval: FA, PO,

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