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Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model

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Abstract

Rationale, aims and objectives: Little is known about hesitancy to receive the COVID-19 vaccines. The objectives of this study were (1) to assess the perceptions of healthcare workers (HCWs) and the general population regarding the COVID-19 vaccines, (2) to evaluate factors influencing the acceptance of vaccination using the health belief model (HBM), and (3) to qualitatively explore the suggested intervention strategies to promote the vaccination.

Methods: This was a cross-sectional study based on electronic survey data that was collected in Iraq during December first-19th, 2020. The electronic survey was designed using Qualtrics. HBM was followed to develop the survey items. A regression analysis was used to identify factors influencing people accepting vaccination. Thematic analysis for participant comments to an open-ended question.

Results: A total of 1680 completed surveys were received. The mean age of 31.2 ± 9.9 years, 53.0% were female and 47.0% were male. The largest group was HCWs (45.7%), followed by general population (37.5%) and health college students (16.8%). Our findings expressed some hesitancy to receive the COVID-19 vaccine with the acceptance rate of 61.7%. The HCWs perceived significantly higher susceptibility and severity of the COVID-19 infection compared to the general population. The HCWs were significantly more likely than the general population to receive COVID-19 vaccine. Concerns with proper storage was the biggest barrier to vaccine receipt. The regression analysis indicated eight factors that were significantly associated with the willingness to receive COVID-19 vaccine: Preventive measures, perceived benefit, perceived barriers, cue to action, subjective norm, supportive of vaccination in general and having received a flu vaccine before.

Conclusions: Awareness campaign can focus on enhancing the vaccine perceived benefit, debunking misconceptions, and increasing the disease perceived severity. Additionally, the public health leaders need to minimize the perceived barriers by providing the vaccines and appeasing people concerns about their storage, effectiveness, and adverse events.

KEYWORDS

acceptance, barriers, COVID-19 vaccine, health belief model, healthcare workers

1 | INTRODUCTION

The coronavirus disease of 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has resulted in a major impact on the global health and economics since its emergence at the end of 2019. As of 16 April 2021 more than 139 million cases and over 2.99 million deaths have occurred globally since the start of the pandemic.[1] Different treatment strategies have been employed to manage the disease,[2,3] however, the number of cases and deaths continue to increase. Therefore, preventive measures, such as social distancing and wearing facial masks, represent a pivotal strategy to reduce the transmission rates of the disease.[4] In addition, there is an urgent need for a vaccine in order to effectively prevent spread of infections.

Several vaccines have been developed against SARS-CoV-2 and have shown promising results in clinical trials.[5-7] One of the leading examples is the mRNA-based vaccine (known as BNT162b2) developed by Pfizer-BioNTech pharmaceutical companies, which demonstrated to be safe and offer protection in subjects after receiving the second dose.[8] Additionally, mRNA-based vaccine (known as mRNA-1273) developed by Moderna showed favourable results in clinical trials published in the New England Journal of Medicine.[5] Both vaccines were granted emergency use authorization by the Food and Drug Administration (FDA) and European Medicines Agency (EMA), respectively. Another promising vaccine is the DNA-based vaccine (known as Vaxzevria) developed by Oxford-AstraZeneca which was authorized for use by the U.K Medicines and Healthcare products Regulatory Agency (MHRA).[9] The World Health Organization (WHO) granted emergency validation to the Pfizer/BioNTech and AstraZeneca COVID-19 vaccine.[10] A heterologous recombinant adenovirus (rAd)-based vaccine, Gam-COVID-Vac (Sputnik V) was developed by the Gamaleya Center, Russia.[11] Lastly, two inactivated virus vaccines were developed by Sinovac and Sinopharm in China.[12] As of January 20, the National Committee for Drug Selection at Iraqi Ministry of Health (MOH) approved three vaccines for emergency use: Pfizer/BioNTech, AstraZeneca and Sinopharm. Thereafter, the MOH ordered millions of doses from the Pfizer/BionTech, AstraZeneca and Sinopharm vaccines. On 28 February 2021, the first batch of COVID-19 vaccines was received by Iraqi MOH.[13]

Yet, despite the existing data on the safety and effectiveness of the vaccines, scepticism regarding their use exists worldwide. For example, in June 2020, the acceptance rate of COVID-19 vaccine in Russia was 55% and in France was 59%.[14] This may present a problem as it is required that a majority of the population receives the vaccine to build herd immunity. Therefore, it is pivotal to understand the perceptions and motivations of the population toward the candidate COVID-19 vaccine.

Existing evidence provides some information regarding the public openness to receive the candidate COVID-19 vaccines.[14] However, little is known about the perceptions and beliefs the populations hold regarding the vaccines as well as the motivations behind accepting or resisting them. It is particularly interesting to predict how this will play out in the Middle East as we are not currently aware of any such surveys conducted in the region. The objectives of this study were (1) to assess the perceptions of healthcare workers (HCWs) and the general population of the candidate COVID-19 vaccines, (2) to evaluate factors influencing the acceptance of vaccination using the health belief model (HBM), and (3) to explore the suggested intervention strategies to promote the likelihood of vaccination. Information gained from this study can help in planning future campaigns to raise awareness about the COVID-19 vaccines.

2 | METHODS

2.1 | Study design and participants

This was a cross-sectional study based on electronic survey data that was collected during December first-19th, 2020. The study was conducted before the arrival of COVID-19 vaccine(s) to Iraq. The target population were adult general population and HCWs. The electronic survey was designed using Qualtrics and had two versions, English version for HCWs and Arabic version for general population including students of the health-related colleges. Healthcare students received the English version, but the Arabic version was open for public who may contain different college students. The English version was distributed via five professional Facebook groups for HCWs while the Arabic version was distributed via two public Facebook groups. Data collection started after obtaining the study approval from the Ethical Committee at the University of Baghdad College of Pharmacy. The survey was voluntary and anonymous.

2.2 | Theoretical framework

Health belief model (HBM)[15] can serve as a useful theoretical framework not only to explore the motives of individuals willing to vaccinate, but even more importantly to investigate the reasons behind refusing vaccination. The major premise of this model is that existing beliefs can predict future behaviours. When applied to disease prevention, it suggests that one's willingness to prevent an illness combined with their expectations of a particular action (such as receiving a vaccine) can serve as a predictor for future behaviours.

HBM includes five major constructs, namely: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action[15] (Figure 1). Perceived susceptibility refers to an individual's belief about the likelihood of acquiring a disease. Perceived severity refers to the individual's feelings of the severity of such illness. Perceived benefits construct is related to one's perception of the usefulness of a particular health behaviour. Perceived barriers correspond to the individual's assessment of obstacles that could prevent people from performing that particular health behaviour. Lastly, cues to action, refer to the cues that stimulate a specific behaviour.[16]

2.3 | The survey items

The study items were adopted with modification from a previous study which assessed perceptions of healthcare providers regarding

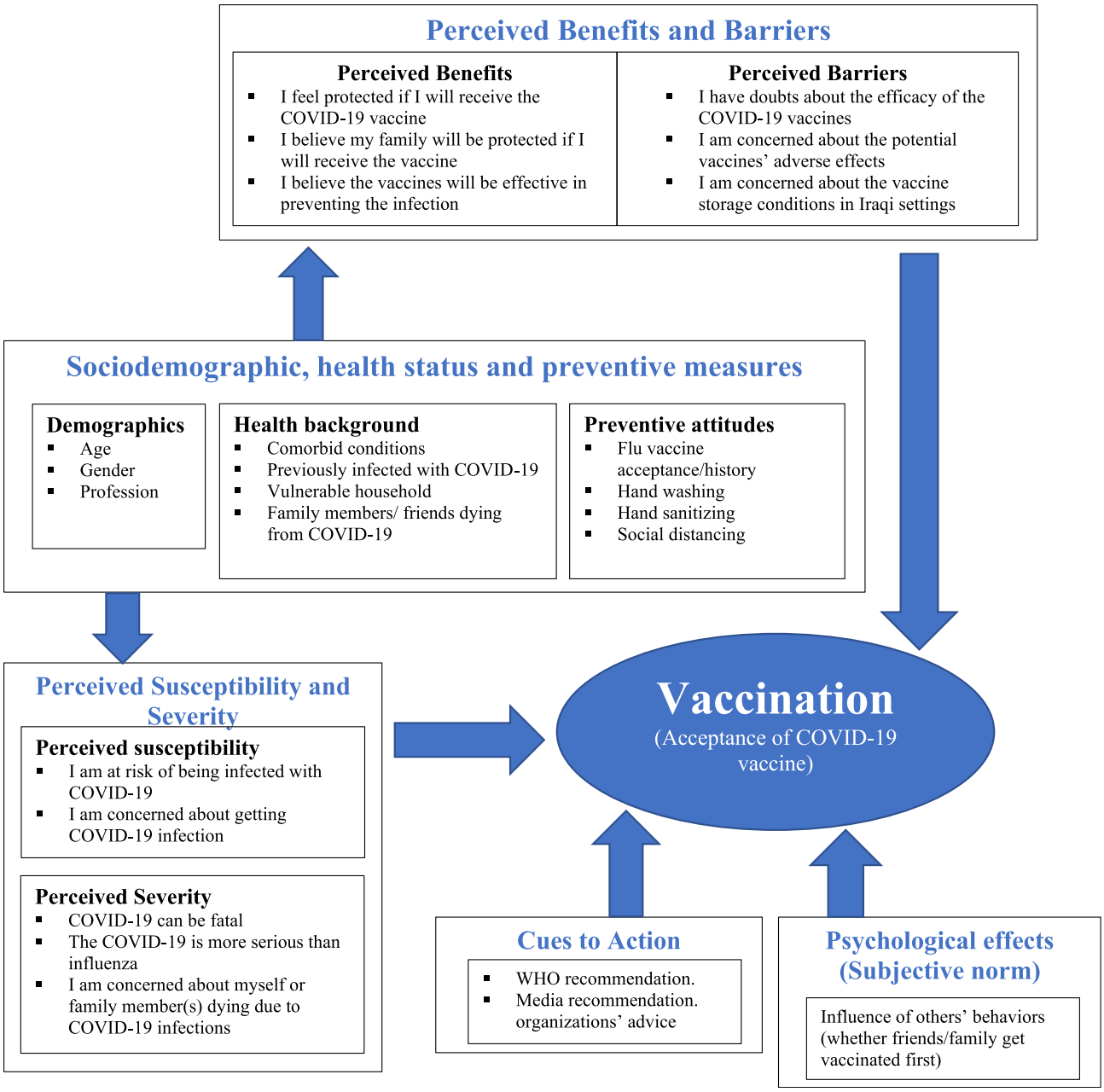

FIGURE 1 Health belief model domains and variables have the potential to influence people's acceptance of receiving a COVID-19 vaccine

flu vaccines.[17] We added five survey items about preventive measures of COVID-19. Additionally, the survey included five items about acceptance of vaccination in general, taken flu vaccine, COVID-19 vaccine acceptance, the preference origin of the COVID-19 vaccine and the main source of COVID-19 vaccine information. The questionnaire consisted of four sections with 34 items. The survey mainly included close-ended questions and one open-ended question. These included (1) sociodemographic, health status, experience with COVID-19 and vaccination, (2) preventive measures, (3) the HBM domains, and (4) a comment on how to enhance people awareness about COVID-19 vaccine. Two experts in Social and Administrative Pharmacy were involved in the developing of the questions.

The first section addressed the sociodemographic information including age, gender, profession, place of living, education level and smoking status. The participants were asked if they have co-existing diseases or take immunosuppressants. They were also asked if they live with vulnerable family members, have COVID-19 infection, or have any family member/ friend have COVID-19 infection or died from COVID-19 infection. Other questions included perception about vaccination in general, whether or not received flu vaccine, intention to take COVID-19 vaccine, source of vaccine preferred and source of information about COVID-19 vaccine(s). Second section included four items on 5-point Likert scale asking participants about wearing facemasks outside home, frequent hand washing, using hand sanitizers and avoiding social gatherings.

The third section include 14 items of the HBM representing the five domains of the HBM model in addition to a subjective norms construct (from Theory of Reasoned Action) (Figure 1). Five domains of the HBM were explored in this study included perceived susceptibility (2 items), perceived severity (3 items), perceived benefits (3 items), perceived barriers (3 items), and cues to action (2 items). The subjective norms construct was added because the behaviour of close people (family and close friends) may impact people acceptance of the vaccination. The subjective norms item was "if participants were more likely to vaccinate if colleagues/friends are vaccinated". The items used 5-point Likert scale (from strongly disagree to strongly agree and from extremely unlikely to extremely likely). The researchers used the HBM to organize the survey items and consequently test the model to predict the participants potential use of the vaccine candidates. The last part has one optional open-ended questions: "Do you have any comments on enhancing the awareness and likelihood of getting vaccinated against COVID-19?"

To eliminate the language barrier, the general population survey was translated to formal Arabic by the authors and the translation was validated by two bilingual native Arabic scholars. The survey was pretested in a pilot study with 40 participants. Cronbach alpha was measured for the pilot study to make sure the items represented the measured HBM domains. Additionally, appropriate revisions were conducted according to the pilot study feedback.

2.4 | Statistical analyses

Descriptive statistics (means, SD, frequencies and percentages) were conducted for all survey items. Data was analysed using SPSS software version 25. The Mann–Whitney test was used to compare the two groups of the participants (HCWs and general population) in terms of willingness to take COVID-19 vaccine and the difference according to the domains of the HBM. A multivariate regression analysis was used to identify factors influencing people accepting vaccination. The multivariable regression analysis was conducted to measure the relationships between the independent variables (HBM domains, and personal characteristics) and the outcome variable (accepting taking the COVID-19 vaccine). The 12 independent variables including variables representing the 6 HBM domains and other 6 selected variables. Each variable in the regression about HBM represents the average of the domain items (mostly the average of 2–3 items of each domain/construct). The other selected variables included 6 items representing personal characteristics (age and gender), accepting vaccination in general, taking flu vaccine, adhering to preventive measures and dying of family/close friend dies due to the COVID-19. The independent variable of the preventive measures in the regression analysis represents the average of the four preventive measure items: wearing facemask outside home, washing hands, using hand sanitizers and avoiding social gatherings. Cronbach alpha was used to measure the internal validity (reliability) of the HBM item scales which represent the four domains in addition to the scale of the preventive measures. p-value of less than 0.05 was considered statistically significant.

2.5 | Thematic analysis

The researchers extracted qualitative data from the comments on the open-ended question in the survey "Do you have any comments on enhancing the awareness and likelihood of getting vaccinated against COVID-19?" Three hundred participants wrote comments regarding their suggestions to increase people awareness and likelihood to receive COVID-19 vaccination in addition to perceived barriers and general perceptions toward the vaccine(s). The comments written in Arabic were translated to English.

During the qualitative analysis stage, we needed to identify the themes from the participant comments. We followed the six phases of thematic analysis described by Braun and Clarke, 2006 which include familiarizing with data (comments), generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report.[18]

The comments were cross-checked by three research team members. Inductive analytic methodology (data-driven) was used and constructivist paradigm was followed for the qualitative phase.[19] This means we did not rely on the HBM to come with the themes, but we construct the themes and subthemes from the common trends emerging from the participant comments. Finally, to enhance the credibility and trustworthiness of the findings, peer checking/debriefing was performed two times to validate the qualitative analysis.[20]

3 | RESULTS

A total of 1967 surveys were conducted. 287 subjects were excluded due to completing less than 90% of the questions, yielding 1680 completed surveys. As summarized in Table 1, the characteristics of participants were the following: Mean age of 31.2 ± 9.9 years, 53.0% were female and 47.0% were male. Additionally, 70.3% of participants had college degree or higher education. The majority of participants were HCWs (45.7%), followed by general population (37.5%) and health college students (16.8%).

More than 42% of the participants had family members or close friends died from COVID-19 infection. Two-thirds (63.7%) of the respondents were from Baghdad, but participation was noted from all provinces. Perceptions of respondents toward vaccination was summarized in Table 2. About two-thirds (62.8%) of the participants were supportive of vaccination in general. More than half (61.7%) of respondents strongly agreed or somewhat agreed to take the prospective COVID-19, 22.7% were undecided, and only 15.6% were not planning to take the vaccine. More than two-thirds (68.3%) of the participants reported social media, newspapers, and television as sources of information on COVID-19 vaccines. In contrast, 44.7% rely on scientific sources such as scientific webinars or scientific publications and 20.1% rely on healthcare providers (HCPs) (physicians or pharmacists) as a source of the vaccine information. Lastly, 5.5% of participants reported not being informed.

High compliance with preventive measures was observed in more than two thirds of respondents. This was noted in those who

TABLE 1 The participant characteristics

Characteristic	Subcategories	Frequency	%
Profession ($n = 1666$)	Retired	38	2.3
	College student	75	4.5
	Self-employed	185	11.1
	Governmental employee	326	19.6
	Healthcare practitioners	372	22.3
	Pharmacist	314	18.9
	Physician	63	3.8
	Dentist	13	0.8
	Health college student	280	16.8
Professional category ($n = 1666$)	General population	624	37.5
	Healthcare workers[a]	762	45.7
	Health college student	280	16.8
Degree ($n = 1672$)	Elementary	10	0.6
	Middle/High school	485	29.0
	BSc	824	49.3
	Graduate degree	331	19.8
	Board degree	22	1.3
Gender	Female	890	53.0
	Male	790	47.0
Smoking status ($n = 1678$)	Previous smoker	344	20.5
	Current smoker	1201	71.6
	Never smoked	133	7.9
Vulnerable household members ($n = 1676$)	Yes	916	54.7
Family members or close friends dying from COVID-19 infection ($n = 1679$)	Yes	710	42.3
Continues variable	*N*	Mean	SD
Age (years)	680	31.18	9.87

[a]Healthcare workers represented pharmacist, physician, dentist and health practitioners.

implemented the desired preventive action either always or often times. More specifically, 89.8% of respondents reported handwashing, 82.8% reported wearing facemask outside home, 76.2% reported using hand-sanitizers and 72.6% reported avoiding social gathering (Table 3). In the Mann–Whitney test to compare the willingness to receive the vaccine, health college students were considered as part of general population as they have not graduated yet. The Mann–Whitney test shows that HCWs were significantly (p-value <0.05) more likely than the general population to follow preventive measures and receive COVID-19 vaccine. These differences are outlined in Table 4.

In respect to the HBM domains, perceived susceptibility and severity of the COVID-19 infection and perceived benefit of the vaccine were all noted in the majority of respondents. It is worth mentioning that HCWs perceived significantly (p-value <0.05) higher susceptibility and severity of the COVID-19 infection compared to the general population (Table 4). Specifically, 73.8% reported being at high risk of infection and 61.9% reported concerns about the infection. Additionally, 76.0% believed that COVID-19 infection to be fatal and 87.5% perceived it to be more serious than influenza infection. As far as perceived benefits, the vaccines were thought to be effective (63.4%) and to protect the respondents (57.0%) and their families (64.5%) from the infection (Table 5).

Three main barriers to vaccine acceptance were highlighted. The barriers include concerns about storage conditions (84.7%), adverse events (62.6%) and effectiveness of the vaccine (44.5%). Lastly, the cues to actions domain indicated openness to vaccine recommendations from three main entities: World Health Organization (WHO) (81.3%), healthcare providers (73.2%) and the media (73.2%) (Table 6). According to the Mann–Whitney test, the general population perceived significantly (p-value <0.05) higher barriers and cue to action toward the vaccination compared to the HCWs (Table 4). Lastly, the influence of subjective norms (such as peers) on one's acceptance to vaccinate was evaluated. Accordingly, 66.0% of the respondents reported willingness to vaccinate if their colleagues /friends were to be vaccinated first (Table 6).

The internal validity (reliability) of the items in each scale was measured using Cronbach's alpha. All the Cronbach's Alpha values were above 0.6 and hence were accepted, with the exception of perceived barrier, which was 0.59 (Table 7). In addition, the perceived

TABLE 2 The participant perceptions toward vaccination

Variable	Characteristic	Frequency	%
I support vaccinations in general ($n = 1680$)	I am impartial (neutral)	520	31.0
	I am not supportive	105	6.3
	I am supportive	1055	62.8
I received influenza vaccination ($n = 1680$)	No	1127	67.1
	Yes	553	32.9
Preferred source of COVID-19 vaccine[a]	U.S origin	841	55.3
	UK origin	992	65.2
	Russian origin	187	12.3
	Chinese origin	199	13.1
Sources of COVID-19 vaccine information[a]	Social media/TV/newspaper	1145	68.3
	Scientific sources	750	44.7
	Friends/collogues	211	12.6
	Healthcare providers[b]	253	20.1
	Not informed	92	5.5
I am planning to receive the COVID19 vaccine	Strongly disagree	128	7.6
	Somewhat disagree	134	8.0
	Neutral	380	22.6
	Somewhat agree	401	23.9
	Strongly agree	637	37.9

[a]Choose all that apply answers (i.e., you can choose more than one). $N = 1680$.
[b]This choice was only available for general population and students (Arabic version). Healthcare provides = physician, pharmacist.

TABLE 3 Compliance with preventive measures against COVID-19 infection

Preventive measure	Never *N* (%)	Rarely *N* (%)	Sometimes *N* (%)	Often *N* (%)	Always *N* (%)	Mean (SD)
Wear facemask outside home ($n = 1678$)	25 (1.49)	79 (4.71)	185 (11.0)	439 (26.1)	950 (56.6)	4.32 (0.95)
Wash hands ($n = 1678$)	3.0 (0.18)	17 (1.01)	151 (9.00)	524 (31.2)	983 (58.6)	4.47 (0.72)
Use hand sanitizers ($n = 1678$)	27 (1.61)	100 (5.96)	272 (16.2)	458 (27.3)	821 (48.9)	4.12 (1.00)
Avoid social gatherings ($n = 1677$)	34 (2.03)	84 (5.01)	341 (20.3)	694 (41.4)	524 (31.3)	3.95 (0.95)
Average of the 4 items						4.22 (0.68)

barriers scale had three items with the highest mean (4.25) corresponding to concern about the vaccine storage condition. Other perceived barriers had lower means (3 and 3 respectively).

Multiple linear regression analysis used in the model included the following 12 independent variables: 6 HBM variables (the average of each scale), preventive measure variable (the average of 4 items), 3 demographics (age, gender and dying of relative sue to the pandemic), and 2 items representing general vaccination perceptions and influenza vaccine intake. The regression model resulted in an acceptable R-square (0.68), indicating it is capable of explaining 68% of the outcomes variable variance. According to the collinearity test, the independent variables did not have multicollinearity (variance inflation factor [VIF] <1). The regression analysis indicated 8 factors that were significantly associated with the willingness to receive COVID-19 vaccine (4 of them represented the HBM domains): Preventive measures, perceived benefit, perceived barriers, cue to action, subjective norm, supportive of vaccination in general and taken flu vaccine before. On the other hand, both gender (male) and perceived barriers had significant negative associations with the willingness to receive the vaccines (Table 8).

3.1 | Qualitative findings

As far as the qualitative section of the survey, participants were asked to suggest interventions to promote COVID-19 vaccine awareness. The findings from the thematic analysis can be divided into three main parts: Intervention strategies, the content of the awareness campaigns and the barriers facing people toward accepting COVID-19 vaccine. Regarding the intervention strategies, the participants suggested multifaceted awareness campaign in addition to forcing the vaccination. Respondents emphasized the use of media sources such as social media and television to draw attention and increase public trust. Furthermore, HCWs' advice and awareness campaigns were

TABLE 4 Comparing the two groups of the participants in terms willingness of receive COVID-19 Vaccine, preventive measures, and the HBM domains

Variable	Profession	*N*	Mean rank	p-value
Planning to receive the COVID19 vaccine	General population	892	803.6	0.024*
	HCWs	761	854.5	
	Total	1653		
Average of preventive measure items	General population	892	801.3	0.019*
	HCWs	760	856.1	
	Total	1652		
Perceived susceptibility	General population	891	764.8	0.000*
	HCWs	760	897.8	
	Total	1651		
Perceived severity	General population	891	803.2	0.032*
	HCWs	760	852.8	
	Total	1651		
Perceived benefit	General population	891	820.5	0.641
	HCWs	759	831.4	
	Total	1650		
Perceived barriers	General population	890	864.8	0.000*
	HCWs	758	777.2	–
	Total	1648	–	–
Cue to action	General population	891	861.0	0.000*
	HCWs	755	779.3	–
	Total	1646	–	–

Note: The HBM domains are represented by the average of the items within each domain. General population include health college students.
*Significant (p-value<0.05) according to Mann–Whitney test.

TABLE 5 The health belief model items: perceived susceptibility, severity, and benefits

Variable	Strongly disagree *N* (%)	Somewhat disagree *N* (%)	Neutral *N* (%)	Somewhat agree *N* (%)	Strongly agree *N* (%)	Mean (SD)
Perceived susceptibility						
"I am at higher risk getting COVID-19" ($n = 1674$)	55 (3.29)	66 (3.94)	318 (19.0)	572 (34.17)	663 (39.6)	4.03 (1.02)
"I am concerned about getting infection" ($n = 1674$)	116 (6.93)	111 (6.63)	411 (24.6)	516 (30.82)	520 (31.1)	3.72 (1.17)
Perceived severity						
"COVID-19 infection can be fatal" ($n = 1676$)	37 (2.21)	111 (6.62)	254 (15.16)	587 (35.02)	687 (41.0)	4.06 (1.01)
"COVID-19 is more serious than flu" ($n = 1676$)	41 (2.45)	53 (3.16)	111 (6.6)	392 (23.39)	1079 (64.4)	4.44 (0.93)
"I am concerned about myself/family dying due to COVID-19" ($n = 1676$)	81 (4.83)	79 (4.71)	215 (12.8)	367 (21.90)	934 (55.7)	4.19 (1.13)
Perceived benefits						
"I feel protected if receive COVID-19 vaccine" ($n = 1676$)	95 (5.67)	141 (8.41)	378 (22.6)	601 (35.86)	461 (27.5)	3.71 (1.12)
"My family will be protected if I receive the vaccine" ($n = 1674$)	152 (9.08)	86 (5.14)	152 (9.08)	358 (21.39)	596 (35.6)	3.74 (1.12)
"I believe the vaccines will be effective" ($n = 1674$)	73 (4.36)	115 (6.87)	406 (24.3)	663 (39.61)	417 (24.9)	3.74 (1.04)

TABLE 6 The health belief model items: perceived barriers, subjective norms, and cues to action

Variable	Strongly disagree *N* (%)	Somewhat disagree *N* (%)	Neutral *N* (%)	Somewhat agree *N* (%)	Strongly agree *N* (%)	Mean (SD)
Perceived barriers						
"I doubt efficacy of the vaccine" ($n = 1673$)	162 (9.68)	264 (15.78)	502 (30.0)	544 (32.52)	201 (12.0)	3.21 (1.14)
"I am concerned about adverse events" ($n = 1670$)	67 (4.01)	157 (9.40)	401 (24.0)	594 (35.57)	451 (27.0)	3.72 (1.08)
"I am concerned about the vaccine storage" ($n = 1671$)	43 (2.57)	55 (3.29)	157 (9.40)	391 (23.40)	1025 (61.3)	4.38 (0.96)
Subjective norms						
"More likely to vaccinate if colleagues/ friends are vaccinated" ($n = 1670$)	116 (6.95)	131 (7.84)	321 (19.2)	499 (29.88)	603 (36.1)	3.80 (1.21)
Cues to action						
"More likely to vaccinate if media recommend" ($n = 1669$)	158 (9.47)	212 (12.7)	405 (24.3)	539 (32.30)	355 (21.3)	3.43 (1.22)
"More likely to vaccinate if WHO recommends" ($n = 1670$)	89 (5.33)	126 (7.55)	263 (15.8)	530 (31.74)	662 (39.6)	3.93 (1.15)

TABLE 7 Reliability results of the health belief model scales and preventive measures

Scale	Number of items	Cronbach's Alpha
Preventive measures	4	0.73
Perceived susceptibility	2	0.61
Perceived severity	3	0.70
Perceived benefit	3	0.92
Perceived barrier	3	0.59
Cue to action	2	0.76

recommended by many participants. Some participants additionally suggested collaborating with health organization such as the WHO to carry out awareness campaigns. Many components were suggested for the campaigns such as explaining the vaccines in detail along with the benefits, complications, and adverse drug reactions (ADRs) of the vaccines in addition to debunking vaccine misconceptions. Furthermore, many respondents recommended making the vaccines available in the first place and prioritizing HCWs and other frontline workers to be vaccinated first (See participant quotes in Table S1). In terms of HBM, the awareness campaign comments basically focused on enhancing the perceived benefit of the vaccine and increasing perceived severity of the disease (COVID-19). Additionally, they also referred to cue to action strategies by the MOH, the WHO and media awareness campaign (see the supplementary-Table S1).

The qualitative data collected also included barriers behind participants' hesitation to receive the vaccines. Some of the common barriers voiced were concerns about storage conditions, preferring alternate methods to prevent infections such as wearing mask or relying on natural immunity, lack of long-term studies, concerns about effectiveness and adverse events of the vaccine(s). Misconceptions about the vaccines were also noted. These comments can demonstrate high barrier perceptions toward the vaccine(s) from some hesitant participants.

TABLE 8 Multiple linear regression analysis of factors influencing willingness to take COVID-19 vaccine

Independent variable	Standardized coefficients Beta	p-value	Collinearity statistics	
			Tolerance	VIF
Preventive measures[b]	0.044	0.006*	0.80	1.26
Perceived susceptibility[a]	0.027	0.119	0.66	1.51
Perceived severity[a]	−0.004	0.827	0.67	1.50
Perceived benefit[a]	0.373	0.000*	0.44	2.28
Perceived barriers[a]	−0.167	0.000*	0.77	1.30
Cue to action[a]	0.152	0.000*	0.42	2.39
Subjective norm	0.093	0.000*	0.47	2.12
Gender	−0.048	0.002*	0.86	1.16
Family/friend died due to COVID-19	−0.016	0.274	0.99	1.01
Support vaccination	0.245	0.000*	0.61	1.64
Took flu vaccine	0.036	0.012*	0.97	1.03
Age	−0.017	0.251	0.94	1.06

Note: R-square = 0.678. Subjective norms= "I am more likely to vaccinate if my colleagues /friends are vaccinated", * Significant (p-value <0.05).
[a]Each variable in the regression about HBM represents the average of the domain items (mostly the average of 2–3 items within each domain).
[b]The variable of the preventive measures represents the average of the four preventive measure items: Wearing facemask outside home, washing hands, using hand sanitizers and avoiding social gatherings.

4 | DISCUSSION

Our findings expressed some hesitancy to receive COVID-19 vaccines with the acceptance rate of 61.7%. More one-third of the participants were either undecided (22.7%) or not planning (15.6%) to receive the vaccine. This reluctant toward the COVID-19 vaccines existed despite high national and global rates of infection and death.[1] In addition, this

study has shown that HCWs were significantly more accepting to be vaccinated than general population. One possible explanation might be the perceived risk of contracting the infection through direct involvement with COVID-19 patients, or due to higher level of medical knowledge. Similarly, a survey conducted in the U.S. that involved 991 adult participants found that only 57.6% reported acceptance to vaccinate.[21] However, a higher proportion (71.5%) was found to be willing to vaccinate in a larger sample size in a global study involving 13 426 participants from 19 countries.[14]

The majority (68.3%) of participants reported reliance on different media sources, including social media, newspapers and television as sources of information on the prospective COVID-19 vaccine. During the pandemic, media, particularly social media has played a critical role in spreading information as it is very easy and inexpensive to access for many users. Media can be a double-edged sword as it can lead to rapid communication of misinformation which may contribute to the unrealistically negative attitudes toward the prospective vaccines.[22,23] Similarly, a survey of 11 242 participants conducted in the U.S. that included has revealed that traditional media sources like television, radio or newspapers were the most widely used (91.2% of participants) source of information about COVID-19.[24]

Employing the HBM has revealed useful information about the influence of the various domains on the acceptance of the vaccine. According to the regression analysis, three HBM factors had significant positive association with the willingness to receive the vaccines including perceived benefits, the cues to action, and subjective norm. Conversely, participants who expressed high barriers were significantly less likely to be vaccinated.

Perceived benefits of the vaccines were also noted in our study. The majority of participants felt that the vaccine would be effective (63.4%) and would protect them (57%) and their families (64.5%) from getting the infection. Belief in the vaccine benefit to prevent infections and subsequent complications was also common among Chinese populations.[25] Likewise, a study conducted in the U.S. in 2021 found that perceived benefit of the vaccines and perceived susceptibility of infection to be significant predictors for vaccination acceptance.[26]

Perceived susceptibility and severity of COVID-19 were appreciated in our study sample. Most participants expressing concerns about contracting the infection (61.9%), as well as belief of being susceptible to it (60%) or being at high risk (73.8%). Perceived severity of the COVID-19 infections was also highlighted in most of our respondents who believed it can cause death (76%) or that it is more serious than flu (87.5%). The HCWs perceived significantly higher susceptibility and severity of the COVID-19 infection compared to the general population. A recent Iraqi study found that HCPs perceived a high risk of infection due to COVID-19 pandemic which may also impact their families.[27] In contrast, a study in China that assessed demand and hesitancy toward COVID-19 vaccines, participants were surprisingly found to have low perception of susceptibility.[25]

The main barriers expressed by the participant comments were concerns about the vaccine effectiveness, adverse events, storage conditions, inadequate evidence from clinical trials and the widespread of misconceptions about the vaccine. These qualitative findings were also in line with the HBM quantitative finding where 44.5% were concerned about the vaccine effectiveness, 62.6% were concerned about adverse events and 84.7% were concerned about the storage conditions. A recent article showed that the Iraqi healthcare system has a limited resources to face COVID-19 pandemic.[28] The general population perceived significantly higher barriers toward the vaccination compared to the HCWs which is probably because HCWs are more knowledgeable about the effectiveness and side effects of the vaccines. Similarly, a study conducted in the U.S. listed adverse events, fear of needles and safety concerns as the three significant perceived barriers.[26] This was also replicated in the study conducted in China which listed concerns about safety, efficacy, and cost as the main barriers.[25] In March and April 2021, several European countries have suspended the AstraZeneca Covid-19 vaccine, while the U.S. FDA paused the use of the Johnson & Johnson COVID-19 vaccine after several suspected reported deaths among people who received the vaccine due to a rare, but severe type of blood clot following vaccination[2930]Such news may increase people hesitancy toward COVID-19 vaccination. It is worth mentioning that this rare/severe blood clotting side effect was not reported at the time of the study and it might lower the acceptance rate in the countries using these two vaccines in the future. Hence, it is very imperative that awareness campaigns target these barriers to improve vaccine acceptance.

On the other hand, the study emphasized the significant effect of subjective norms, defined as the peers' influence on personal behaviours. More than two thirds of the participants (66%) were significantly more likely to vaccinate if colleagues/friends would be vaccinated first. It was also reported in a previous study which used Theory of Reasoned Action that this tendency in peer influences how they take their medications.[31]

Regarding cues to actions, the major influencers of our participants' acceptance of the vaccines were found to be recommendations from the WHO, HCPs (physician/pharmacist), and the media. Through their comments about the awareness campaigns, the participants have stressed the role of media, including social media and television in raising awareness about the vaccine. This came in line with the quantitative results of HBM which showed that 73.2% of the participants trusted the HCPs' recommendations to take the vaccine whereas 81.3% of them trusted the WHO recommendations in this regard. Involvement of HCPs and collaboration with the WHO for the awareness campaigns was also recommended.

Although this study has a unique method integrating quantitative and qualitative findings, it experienced some limitations. One is the small size, and the other limitation is that most of the respondents were from Baghdad, and therefore it is perhaps not a true representation of the entire population in Iraq.

5 | CONCLUSIONS

The HBM successfully predicted the factors influencing the people acceptance of vaccination against COVID-19. Our findings expressed

some hesitancy to receive the COVID-19 vaccine with the acceptance rate of 61.7%. Concern with proper storage was seen as the biggest reported barrier to vaccine receipt. Reliance on social media, newspaper and television for vaccine information was noted in this survey. Additionally, the WHO and healthcare providers were seen as a reliable source of recommendations. The participant comments showed awareness campaign with multifaceted strategies is necessary to enhance people awareness and likelihood to accept the vaccination. This campaign should focus on enhancing the vaccine perceived benefit, debunking misconceptions, and increasing the disease perceived severity. Additionally, the public health officials need to minimize the perceived barriers by providing the vaccines and appeasing people concerns about their effectives, adverse events and storage.

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CONFLICT OF INTEREST

No conflict of interest to declare.

AUTHOR CONTRIBUTIONS

Basma Zuheir Al-Metwali participated in revising survey items, survey translation, survey distribution, analysing qualitative data, writing and reviewing the manuscript. Ali Azeez Al-Jumaili participated in the study designing, developing the survey items, survey translation, survey distribution, analysing quantitative and qualitative data, writing and reviewing the manuscript. Zahraa Adel Al-Alag participated in revising survey items, analysing qualitative data, figure constructing and writing and reviewing the manuscript. Bernard Sorofman participated in the study designing, revising survey items and reviewing the manuscript. All authors have read and approved the final version of the manuscript.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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