Integrating Health Belief model to determine factors associated with COVID-19 Vaccine Acceptance in Lebanon: Differences between health care workers and non-healthcare workers

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Research

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Abstract

Background:

Vaccine acceptance is critical to the success of immunization programs, especially for emerging infectious diseases. This study aims to assess the willingness to receive the COVID-19 vaccine, and the factors associated with this willingness among healthcare workers (HCWs) and non-healthcare workers in Lebanon.

Methods:

A web-based cross-sectional survey was conducted among Lebanese adults aged 18 years and above during November 2020 among Lebanese adults from all Lebanese provinces using a snowball sampling technique. Data were collected using an anonymous Arabic questionnaire that included sociodemographic, health-related variables, intention to receive COVID-19 vaccine, and the Health Belief Model covariates. Multivariable logistic regression analyses were performed to identify the factors associated with the COVID-19 vaccine acceptance among the 2 groups.

Results:

A total number of 2802 participants completed the survey. The overall intention to receive a COVID-19 vaccine among the Lebanese adult population was 51.5%. HCWs expressed a higher willingness of getting vaccinated against COVID-19 than non HCWs (65.8% vs. 47%, $p < 0.001$). The factors that are positively associated with the willingness to vaccinate among the general population, non HCWs and HCWs were: older age, being married, living in urban areas, receiving influenza vaccine for this season, higher perception of susceptibility and benefits, concerns related to availability and accessibility of vaccines and recommendation of vaccine from health authorities. However, the previous refusal of any vaccine, concerns about vaccine safety, and side effects impacted negatively this intention. Female gender, importance accounted to religiosity, and concerns about the reliability of the manufacturer were negatively associated with vaccine acceptance among non HCWs. Conversely, good knowledge, vaccine intake by the public, and self-motivation were positively associated with this willingness. Of note, these factors were not significantly associated with such willingness among HCWs.

Conclusion:

To control COVID-19 effectively, efforts targeting modifiable factors driving COVID-19 vaccine acceptance are required to increase the acceptance rate among the Lebanese population.

Background

The emergence and the blowout of the coronavirus disease 2019 (COVID-19) pandemic, is swiftly leading to a topmost wide-reaching public health threat. As specific antiviral treatment options are lacking, countries continue to grapple with the full brunt of the ongoing COVID-19 pandemic that sternly disrupted societies and enormously levy burdens of morbidity and mortality [1–3]. However, the imposed precautionary measures used to control the pandemic such as lockdowns, social distancing, and travel restrictions have contributed to a global economic slump [4–6]. To stop the spread of the pandemic, it was estimated that more than 67% of the population might acquire immunity by either vaccination or infection [7]. Allowing uncontrolled natural infection to achieve this immunity would overrun even advanced health care systems by the surge of morbidity and mortality [8]. Since immunization was considered among the most successful health interventions to control the spread of infectious diseases and the preferred approach to stop the pandemic, hence there is an urgent need to develop a COVID-19 vaccine [9, 10]. In this context, numerous pharmaceutical companies and research centers worldwide were proactive and begin vaccine development at

accelerated pace. It has been reported that 81 prophylactic vaccines candidates against COVID-19 have been submitted for clinical evaluation [5]. Of note, by early March 2021 stringent regulatory agencies around the world had authorized several highly effective vaccines, the shipping of the vaccine doses was initiated by the end of 2020, and countries started subsequently authorizing the emergency use of the COVID-19 vaccines [11, 12].

Despite the great progress made in vaccine development, there are still important challenges facing future vaccines especially their acceptance from the population. However, the novelty of the COVID-19 vaccine, the flood of misinformation across media outlets, and the fast-tracked vaccine development could escalate anxiety and vaccine hesitancy among the population. This uncertainty will constitute a global barrier to the achievement of herds immunity and will threaten the success of vaccination programs which is firmly related to high rates of acceptance rate and coverage [13, 14]. A study conducted in the United States shows an acceptability rate of 67% of a COVID-19 vaccine [15]. Another study among adult populations reported that vaccine hesitancy/resistance was manifested in 35 and 31% in Ireland and the United Kingdom respectively [16]. In addition, several studies have used the health belief model (HBM) to identify factors affecting the acceptance or uptake of the vaccine [17–21]. However, its demand in low-and middle-income countries (LMICs) is less well-studied and there may be different considerations from the population compared to high-income countries.

HCWs are a specific group of the population who encountered high occupational risk particularly frontliners. In addition, their sickness in case they contracted COVID-19 impacted negatively the medical services provided by health facilities. They were also considered by their patients as a reliable source of information regarding vaccines, hence their role in raising awareness and promoting vaccines among their patients. There is a need to prioritize them for vaccination [22]. However, this could not be achievable without their acceptance.

Lebanon, a small Arab Middle Eastern country is enduring severe and prolonged economic depression. Despite the current situation, national efforts were exerted to secure the country's portion of the COVID-19 vaccine through negotiation conducted with Pfizer/BioNTech Company. It was anticipated that the vaccine will reach Lebanon by mid-February 2021. As of January 31, 2021, there were more than 301052 confirmed COVID-19 cases and 3082 deaths reported in Lebanon [23]. Nevertheless, despite vaccine availability, a part of the population could not get vaccinated, due to vaccine hesitancy [24].

As part of the Ministry of Public Health (MOPH) preparedness for the implementation of a national COVID-19 vaccination plan and related future vaccination strategies, MOPH must start gauging current levels of willingness to receive the future COVID-19 vaccine among the Lebanese population, to explore whether there is a difference in the acceptance of vaccine between HCWs and non HCWs and to identify determinants of this intention among these 2 groups. Such information is beneficial for producing well-versed prognoses of what vaccine uptake might be shortly and also help health authorities to adopt the best approach to implement mass immunization plans for the COVID-19 vaccine as well as to address hesitancy through target efforts for building vaccine literacy and improving the uptake.

Therefore, the present study aimed to assess the acceptance rate of the COVID-19 vaccine among HCW and non-HCWs and to evaluate the perceived susceptibility to COVID-19, perceived severity of COVID-19 infection, perceived benefits, barriers of COVID-19 vaccine, and appraise participants' cues to action and self-efficacy. In addition, we sought to identify the determinants of the intention to receive the COVID-19 vaccine among non-healthcare workers and healthcare workers.

Methods

Study design

A cross-sectional study, using an online survey, was carried out in November 2020 among the Lebanese adult population. The sample was selected using a snowball technique from the eight Lebanese governorates (Bekaa, Baalbeck-Hermel, South, Nabatyeh, Akkar, North, Beirut, and Mount Lebanon). Potential respondents were electronically invited to participate. Any Lebanese adult aged 18 years and above was eligible to participate. Participants who refused to give their consent were excluded.

Questionnaire development

An extensive review of the literature was conducted to develop the questionnaire. The HBM was adopted as a theoretical framework to assess HCWs and non-HCWs drives for receiving the COVID-19 vaccine [25, 26].

A 65-item structured questionnaire was prepared. It was reviewed and assessed by a panel of experts for clarity, interpretability, and accuracy of the items. Then, the original English draft was translated and adapted to the Arabic language based on standard translation guidelines[27]. To test survey flow, readability and functionality, the questionnaire was pre-tested among 20 HCWs and 20 non-HCWs. Based on their feedback, minor modifications were made to the questionnaire. The reliability of the questionnaire was checked. A Cronbach's α internal reliability method revealed that the internal consistency of HBM was Cronbach's $\alpha = 0.82$. When divided the population into HCWs and non-HCWs, the internal consistency of the model for HCWs was Cronbach's $\alpha = 0.77$ and Cronbach's $\alpha = 0.87$ for non-HCWs. Furthermore, all the domains of HBM showed good reliability (>0.7). The average time for filling the survey was 8 minutes.

The questionnaire was self-administered and includes the following sections:

- (1) **Sociodemographic covariates**, namely, age, gender, marital status, educational level, urbanicity, health insurance, and religiosity
- (2) **health-related covariates**, such as health status (suffering from chronic disease), living with a person having comorbidities, living with elderly people, living with a child, previous testing for COVID-19 infection, previous infection with COVID-19, and their health status.
- (3) **Previous vaccination behavior** such as having received an influenza vaccine last year (i.e., past behavior), or refusing any type of vaccine in the past.
- (4) **The intention to receive a future COVID-19 vaccine**, assessed by a one-item question answered yes/no basis.
- (5) **Knowledge about vaccine section** consists of 8 questions assessing awareness of HCWs about COVID-19 vaccine. All the items were answered on a true/false basis and an additional "do not know" option. A correct response had a value of '1' and a "wrong" or don't know response had a value of '0'. Hence, the aggregate score for all 8 knowledge questions would range from 0 to 8 points. Participants 'overall knowledge was categorized using modified Bloom's cut-off point, as good if the score was $>60\%$ (5–8 points), and poor if the score was less than 60% (< 5 points)
- (6) The HBM: It comprises six key domains which impact willingness to vaccinate

The perceived susceptibility to COVID-19 section. It consists of 4 questions addressing HCW's views about their risk of getting COVID-19 [28].

The perceived severity section consists of 5 questions that relate to the patient's concerns about the seriousness of COVID-19.

The perceived benefits section comprises 7 questions linked to the perceived outcomes of getting vaccinated against COVID-19 to reduce their susceptibility to or severity of the illness [29].

Perceived barriers consist of 13 questions that identify patient's concerns or negative beliefs about COVID-19 vaccines. Responses to questions related to perceived susceptibility, severity, benefits, and barriers were graded on a 3-point Likert scale, an agreement scale ranging from '1' for disagree to '3' agree.

The cues to action section comprises 7 questions addressing strategies or information sources that promote the willingness to get the COVID-19 vaccine. Responses to statements related to cues of action were sorted on a 3-point Likert scale, an agreement scale ranging from '1' for No, '2' Not sure and '3' Yes.

The self-motivation section comprised 2 statements that addressed HCW's willingness to improve his health, e.g., adopting a healthy lifestyle. Responses to questions related to self-motivation were graded on a 3-point Likert scale, an agreement scale ranging from '1' for never to '3' all the time [30].

For these domains, an "agree" response had a value of '1' and a "disagree" or "neutral response had a value of '0'. Hence, the aggregate score for each domain was calculated except the one related to self-motivation. This was due to the small number of the item. Participants' overall perception of susceptibility, severity, benefits and barriers were categorized using modified Bloom's cut-off point, as high if the score was >60%, and low if the score was less than 60%.

Sample size calculation

According to a previous study, the average proportion of people accepted to be vaccinated is 58% [31]. Therefore, an approximate value of 65% was selected for the calculation of sample size. The expected error rate was set to 1.5%. The sample size was calculated as follows [32, 33]:

$$n = \frac{u_a p (1 - p)}{\delta_x \delta}$$

where $u_a = 1.96$, p is the proportion of vaccinations accepted, and δ is the standard deviation (0.015), leading to 2,037 participants. To reduce the sampling error and increase the study power, a rough estimation was made by multiplying the calculated sample size by 1.37 times, leading to a final sample size of 2,802 participants.

Data collection

An Arabic online self-administered questionnaire using a Google form was disseminated through WhatsApp, SMS, social media, and email using a "snowball" sampling method. A link including informed consent, a brief introduction, the objective of the survey, and instructions for filling the questionnaire was sent. No incentives were provided to participants for participation in the study.

Ethical consideration

Participants were informed that their participation is voluntary and that they were free to withdraw at any time. Written informed consent was obtained for each participant. All information was gathered anonymously and handled confidentially. The study design assured adequate protection of study participants, and neither included clinical data about patients nor configured itself as a clinical trial. Hence, this study was exempted from the ethical approval of the MOPH.

Statistical analysis

The data were analyzed using the statistical software SPSS (Statistical Package for Social Sciences), version 22.0. Descriptive statistics were reported using frequency with percentages for categorical variables. Bivariate analysis was performed to examine factors associated with the dependent variable (willingness to vaccinate) and the demographic variables in addition to the domains of HBM. The relation between nominal variables was tested using the chi-squared test. The variables in bivariate analysis with p-value < 0.2 were entered into multivariable logistic regression. Adjusted odds ratio and their 95% confidence intervals were reported. Three logistic regression analyses were performed to determine the factors associated with the willingness to vaccinate among the Lebanese adult population, HCWs and non HCWs. Hosmer and Lemeshow test was checked to confirm the adequacy of the model. The level of statistical significance was set at a p-value < 0.05.

Results

Baseline information

A total of 2802 respondents participated in the survey, including 679 (24.2%) HCWs and 2123 (75.8%) non-HCWs. The majority of participants were female (70.7%), married (57%), and aged between 30 and 49 years old. Most of them have a good health status (81.7%), an educational level of university degree or more (79.3%), and were living in urban areas (64.3%). Less than 20% of them had a previous history of COVID-19 infection. Only 37.9% of the respondents have

received their influenza vaccine during the past season (2019-2020). However, the influenza vaccination rate increased in the era of COVID-19 among the Lebanese population (43.5%) especially among HCWs (47.3% in the past season vs. 72% in the current season). Around 20% have refused a type of vaccine in the past (Table 1).

Intention to get COVID-19 vaccines

Figure 1 showed the intention of the HCWs and non-HCWs to get vaccinated against COVID-19. The overall Lebanese population acceptance rate of receiving COVID-19 vaccine once available in Lebanon was 51.5%. A higher intention to vaccinate was reported by HCWs (65.8%) compared to the non-HCWs (47%) and 53% of non-HCWs reported hesitancy compared to 34.2% among HCWs.

Table 1
Baseline information of the healthcare workers and non-healthcare samples (N=2802)

	General population	Non HCWs	HCWs
	n(%)	n(%)	n(%)
Gender			
Male	820 (29.3%)	87(27.6%)	233(34.3%)
Female	1983(70.7%)	1536(77.5%)	446(65.7%)
Age			
18-29 years	1062(37.9%)	869(40.9%)	193(28.4%)
30-49 years	1238(44.2%)	877(41.3%)	361(53.2%)
50-65 years	403(14.4%)	296(13.9%)	107(15.8%)
> 65 years	99(3.5%)	81(3.8%)	18(2.7%)
Marital status			
Single	1084(38.7%)	907(42.7%)	117(26.1%)
Married/Engaged	1596 (57%)	1115(52.5%)	481(70.8%)
Other (Divorced or Widowed)	122(4.4%)	101(4.8%)	21(3.1%)
Education Level			
Secondary or less	203(7.2%)	178(8.4%)	25(3.7%)
Technical degree	378(13.5%)	351(16.5%)	27(4%)
University degree or more	2221(79.3%)	1594(75.1%)	627(92.3%)
Urbanicity			
Rural	1000(35.7%)	698(32.9%)	302(44.5%)
Urban	1802(64.3%)	1425(67.1%)	377(55.5%)
Health status			
Fair and below	514(18.3%)	369(17.4%)	145(21.4%)
Good and above	2288(81.7%)	1754(82.6%)	534(78.6%)
Religiosity			
Not important or slightly important	1048(37.4%)	885(41.7%)	163(24%)
Important or very important	1754(62.6%)	1238(58.3%)	516(76%)
Living with a person having comorbidities			
Yes	1527(54.5%)	1161(54.7%)	366(53.9%)
No	1275(45.5%)	962(45.3%)	313(46.1%)
Living with a child			

	General population	Non HCWs	HCWs
Yes	1549(55.3%)	1123(52.9%)	426(62.7%)
No	1253(44.7%)	1000(47.1%)	253(37.3%)
Living with an elderly			
Yes	1218(43.5%)	910(42.5%)	308(45.4%)
No	1584(56.5%)	1213(57.1%)	371(54.6%)
Personal history of COVID-19 diagnosis			
Yes	462(16.5%)	333(15.7%)	129(19%)
No	2340(83.5%)	1790(84.3%)	550(23.5%)
Family member/friend or colleague ever diagnosed with COVID-19			
Yes	1829(65.3%)	1217(57.3%)	612(90.1%)
No	973(34.7%)	906(42.7%)	67(6.9%)
Received vaccination against influenza in the past season			
Yes	1063 (37.9%)	742(35%)	321(47.3%)
No	1739(62.1%)	1381(65%)	358(52.7%)
Received vaccination against influenza in the current season (era of COVID-19)			
Yes	1220(43.5%)	731(34.4%)	489(72%)
No	1582(56.5%)	1392(65.6%)	190(28%)
Refused vaccination of a certain type of vaccine in the past			
Yes	534(19.1%)	434(20.4%)	100(14.7%)
No	2268(80.9%)	1689(79.6%)	579(85.3%)
Total	2802(100%)	2123(75.8%)	679(24.2%)
N frequency, % percentage, HCW Health care worker, Non-HCW Non Health care worker			

HBM constructs among HCWs and non-HCWs

Table 2 displayed the dimensions of HBM as perceived by HCWs and non-HCWs. HCWs reported a higher susceptibility to get infected due to occupational exposure (73.3%) compared to the non-HCWs (49.8%). Around half of HCWs and non HCWs have approximately perceived that there is a greater chance to get infected in the coming months. Similarly, around one-quarter of HCWs and non HCWs reported that their health status makes them more susceptible to get COVID-19. However, 79.1% of HCWs considered that healthy people can get COVID-19 vs. 57.8% among non-HCWs. Non-HCWs reported a higher perception of the severity of COVID-19 infection compared to HWCs where 80.7% of non-HCWs and 54.5% of HCWs considered that COVID-19 could make people very ill or could lead to their death. In addition, 26.5% of non-HCWs reported that COVID-19 is more serious than influenza compared to 13.1% of HCWs. However, 20% of non-HCWs considered that they might die in case they contracted COVID-19.

Regarding the perception of benefits, more than 90% of HCWs agreed about the benefits of COVID-19 vaccine since it makes them less worried about COVID-19 and decreases the likelihood of developing complications from COVID-19. They also agreed that vaccines were among the safest medical products, needed to effectively control the pandemic and that high vaccination coverage could stop the COVID-19 pandemic. Finally, they stated that vaccines could protect their family, their friends, and the whole community from COVID-19. However, less than 70% of non-HCWs displayed a similar perception of the aforementioned benefits.

Non-HCWs showed a higher perception of barriers in all items. The major barriers perceived by non-HCWs were the efficacy of vaccines (92%), the safety of vaccine (85.3%), vaccines' side effects (79.8%), the limited availability of vaccines (75.3%), and the strategy adopted by the health system for the distribution of vaccines (73.3%). Similarly, HCWs perceived vaccine efficacy (85.3%), vaccine safety (72.6%), and side effects of vaccines as main barriers.

In terms of cues to action, recommendation of vaccination from work (84.8%), health authorities (75.8%), and receiving adequate and reliable information about vaccines (71.2%) were the main cues to getting vaccinated among the Lebanese population. Only 42.9% of the Lebanese population could vaccinate if this was recommended by the media. Similar sorting of cues of action was found approximately similar between HCWs and non-HCWs.

Around 70% of the Lebanese did things to improve their health (sport, diet...) and complied with the recommended yearly physical examination and follow-up related to their health status. However, more than 95% of HCWs showed higher compliance towards doing things that improve their health comparing to non-HCWs (around 60%).

Differences between HCWs and non-HCWs in perceiving HBM constructs and willingness to vaccinate:

Table 3 displayed the difference in perception of HBM domains and willingness to vaccinate between HCWs and non-HCWs. The majority of the Lebanese population (77.2%) considered themselves susceptible to get infected by COVID-19. In addition, 86.4% of them were knowledgeable about COVID-19 and 76.5% considered vaccines as beneficial. However, only 7.7% of them perceived COVID-19 as a severe disease and 24.3% of the Lebanese population will took their vaccine based on recommendations provided by multiple sources. 45.4% of the Lebanese population showed a high level of barriers perception. HCWs expressed higher perception of susceptibility to infection than non-HCWs (97.1% vs 70.8%), $p < 0.001$ (OR=13.592, CI 95% (8.627-21.415)). Higher perception of vaccine benefits (aOR=12.199, 95% CI (7.967-18.679)), and higher compliance to cues to action were reported among HCWs than non-HCWs. In addition, they reported a higher knowledge score (OR=1.845, 95%CI (1.380-2.466)) compared to non-HCWs. HCWs also expressed higher intention of getting vaccinated against COVID-19 than non-HCWs (OR=12.199, 95% CI (7.967-18.679)). However, HCWs reported lower perception of barriers (OR=0.259, 95% CI (0.243-0.359)) and a lower perception of severity than non-HCWs.

Determinants of COVID-19 vaccine acceptance among the general population:

Table 4 summarizes the determinants of acceptance of COVID-19 among the Lebanese population. For sociodemographic characteristics, women (aOR=0.569, 95% CI (0.466-0.691)), older age (aOR=0.569, 95% CI (0.466-0.691)) were less willing to get vaccinated compared to their counterparts. However, being married (aOR=1.770, CI 95% (1.466-2.121)) increased the intention of getting vaccinated compared to single participants. Importance accounted to religiosity was associated with lower willingness to vaccinate among the general population (aOR=0.498-0.718). Regarding past vaccine behaviors, people who received their influenza vaccine for the current season were more likely to get vaccinated against COVID-19 (aOR=1.709, 95% CI (1.378-2.120)). However, a history of refusal of any kind of vaccine was associated with a lower vaccine acceptance rate (aOR=0.545, 95% CI (0.435-0.683)). People who were

knowledgeable about the COVID-19 vaccine (aOR=1.793, 95% CI (1.347-2.341) were more likely to get vaccinated. From HBM, perceived susceptibility (aOR=1.560, C.I 95% (1.191-2.043)), benefits (aOR=4.577, 95% CI (0.597-0.955), and cues to action such as recommendation of vaccine by a family member (aOR=1.539, 95% CI (1.098-2.157)), health authorities (aOR=1.66, 95% CI (1.457-1.995) were all positively associated to a higher intention of getting a COVID-19 vaccine. At the same time, barriers such as side effects (aOR=0.586, 95% CI (0.424-0.810)), vaccine safety (aOR=0.417, 95% CI (0.428-0.606)), reliability of the manufacturer (aOR=0.624, 95% CI 0.497-0.784)), and duration of acquired immunity (aOR=0.755, 95% CI (0.597-0.955)) were negatively associated with the intention of getting a COVID-19 vaccine. However, some perceived barriers such as limited accessibility to vaccines (aOR=1.996, 95% CI (1.583-2.513)) and limited availability of COVID-19 in limited quantities for limited categories of the population (aOR=2.399, 95% CI (1.905-3.019)) were positively associated to vaccine acceptance. Finally, self-efficacy revealed by the tendency of people to do things on their own to improve their health (aOR=1.009, 95% CI (1.009-1.985) was positively associated with the willingness to vaccinate.

Table 2

Susceptibility and severity benefits, barriers and cues of actions for getting COVID-19 vaccines as perceived by Health Care Workers and non-Health Care Workers

	General population		Non HCWs		HCWs	
	Disagree/ Neutral	Agree	Disagree/ Neutral	Agree	Disagree/ Neutral	Agree
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Perceived susceptibility of getting infected by COVID-19						
1-I am susceptible of getting infected due to my occupational exposure	1239(44.2%)	1536(55.8%)	1065(68.1%)	1058(49.8%)	181(26.7%)	498(73.3%)
2-There is a great chance to get infected by COVID-19 in the next coming months	1274(45.5%)	1528(54.5%)	937(44.1%)	1186(55.9%)	337(49.6%)	342(50.4%)
3-Even healthy people can get COVID-19	1529(54.6%)	1273(45.4%)	1387(49.5%)	736(57.8%)	142(20.9%)	537(79.1%)
4-My health status make me more susceptible to contract COVID-19	2037(72.7%)	765(27.3%)	1523(71.7%)	600(28.3%)	514(75.6%)	165(23.4%)
Perceived severity and seriousness of COVID-19						
1-Although for most people, COVID-19 causes mild illness, it makes people very ill or fatal	880(31.4%)	1922(68.6%)	571(26.9%)	1552(80.7%)	309(45.5%)	370(54.5%)
2-COVID-19 is more serious than seasonal influenza	2146(76.6%)	656(23.4%)	1560(73.5%)	563(26.5%)	586(86.3%)	93(13.7%)
3-I will be very sick if I get COVID-19	2146(76.6%)	656(23.4%)	1560(73.5%)	563(26.5%)	586(86.3%)	93(13.7%)
4-If I get infected, I might require hospitalization	2200(78.5%)	602(21.5%)	1569(73.9%)	554(26.1%)	631(92.9%)	48(7.1%)
5-If I get COVID-19, I might die	2315(82.6%)	487(17.4%)	1677(79%)	446(21%)	638(94%)	41(6%)

	General population		Non HCWs		HCWs	
Perceived benefits of COVID-19 vaccine						
1-It makes me feel less worried about COVID-19	677(24.2%)	2125(75.8%)	637(30%)	1486(70%)	40(5.9%)	639(94.1%)
2-It decreases my chance of having complications from COVID-19 if infected	742(26.5%)	2060(73.5%)	703(33.1%)	1420(66.9%)	39(5.3%)	640(94.3%)
3-Vaccines are among the most tested/safe medical products	673(24%)	2199(76%)	648(30.5%)	1475(69.5%)	25(3.7%)	654(96.3%)
4-When I get vaccinated, I protect my family and friends from infection	773(27.6%)	2029(72.4%)	728(34.3%)	1395(65.7%)	45(5.8%)	634(93.4%)
5-When I get vaccinated, the whole community benefits by preventing the spread of COVID-19	751(26.8%)	2051(73.2%)	717(33.8%)	1406(66.2%)	34(5%)	645(95%)
6-COVID-19 vaccination is an effective way to prevent and control COVID-19	759(27.1%)	2043(72.9%)	724(34.1%)	1399(65.9%)	35(4.6%)	644(94.8%)
7-High vaccination coverage globally is required to stop COVID-19 pandemic	833(29.7%)	1969(70.3%)	778(36.6%)	1345(63.4%)	55(8.1%)	624(91.9%)
Perceived barriers for COVID-19 vaccination						
1-Novelty of vaccine (not used before)	922(32.9%)	1880(67.1%)	610(28.7%)	1513(71.3%)	312(45.9%)	367(54.1%)
2-Side effects of COVID-19 vaccine	665(23.7%)	2137(76.3%)	428(20.2%)	1695(79.8%)	237(34.9%)	442(65.1%)

	General population		Non HCWs		HCWs	
3-Efficacy of COVID-19 vaccine	270(9.6%)	2532(90.4%)	170(8%)	1953(92%)	100(14.7%)	579(85.3%)
4-Safety of COVID-19 vaccine	498(17.8%)	2304(82.2%)	312(14.7%)	1811(85.3%)	186(27.4%)	493(72.6%)
5-Cost of COVID-19 vaccine (willingness to pay)	1890(67.5%)	912(32.5%)	1277(60.2%)	846(39.8%)	613(90.3%)	66(9.7%)
6-Accessibility (geographical distribution of sites)	1757(62.7%)	1045(37.3%)	1240(58.4%)	883(41.6%)	517(76.1%)	162(23.9%)
7-Availability of COVID-19 vaccine in limited quantities for limited categories of the population	774(27.6%)	2028(72.4%)	525(24.7%)	1598(75.3%)	249(36.7%)	430(63.3%)
8-If the COVID-19 vaccine is halal	1987(70.9%)	815(29.1%)	1444(68%)	679(32%)	543(80%)	136(20%)
9-Reliability of the manufacturer/ source of supply	1034(36.9%)	1768(63.1%)	683(32.2%)	1440(67.8%)	351(51.7%)	328(48.3%)
10-Strategy of health system for distribution of vac.	860(30.7%)	1942(69.3%)	567(26.7%)	1556(73.3%)	293(43.2%)	386(56.8%)
11-Vaccine mode of administration (needles use...)	2183(77.9%)	619(22.1%)	1553(73.2%)	570(26.8%)	630(92.8%)	49(7.2%)
12-Vaccine frequency (number of doses required....)	2075(74.1%)	727(25.9%)	1476(69.5%)	647(30.5%)	599(88.2%)	80(11.8%)
13-Immunity duration	1603(57.2%)	1199(42.8%)	1099(51.8%)	1024(48.2%)	504(74.2%)	175(25.8%)
Cues of action (I will take COVID-19 if....)						
1-I was given adequate and reliable information	807(28.8%)	1995(71.2%)	604(28.5%)	1519(71.5%)	203(29.9%)	476(70.1%)

	General population		Non HCWs		HCWs	
2-It is recommended by the health facilities	1246(44.5%)	1556(55.5%)	1034(48.7%)	1089(51.3%)	212(31.2%)	467(68.8%)
3-It is recommended by a family member	1583(56.5%)	1219(43.5%)	1212(57.1%)	911(42.9%)	371(54.6%)	308(45.4%)
4-It is recommended by the health authorities	678(24.2%)	2124(75.8%)	575(27.1%)	1548(72.9%)	103(15.2%)	576(84.8%)
5-It is recommended by the media	1600(57.1%)	1202(42.9%)	1220(76.3%)	903(42.5%)	380(56%)	299(44%)
6-It is recommended by my work	425(15.2%)	2377(84.8%)	359(16.9%)	1764(83.1%)	66(9.7%)	613(90.3%)
7-It is taken by many in the public	1086(38.8%)	1716(61.2%)	839(39.5%)	1284(60.5%)	247(36.4%)	432(63.6%)
Health motivation						
1- Doing things on my own to improve my health	806(28.8%)	1996(71.2%)	787(37.1%)	1336(62.9%)	19(2.8%)	660(97.2%)
2- Following the recommended physical examinations and illness-related visits	834(29.8%)	1968(70.2%)	812(38.2%)	1311(61.8%)	22(3.2%)	657(96.8%)

Table 3: Comparison of perceived susceptibility, severity, benefits, barriers, and knowledge between HCWs and non HCWs in the Lebanese population

	Perceived susceptibility		P-value	OR	95 % C.I.	
	Non-susceptible	Susceptible			Lower	Upper
	n(%)	n(%)				
Population groups			<0.001			
Non HCWs (N=2123)	620(29.9%)	1503(70.8%)	Ref			
HCWs (N=679)	20(2.9%)	659(97.1%)	<0.001	13.592	8.627	21.415
Total	640(22.8%)	2162(77.2%)				

	General population		Non HCWs	HCWs		
	Perceived severity					
	Non-severe	Severe	<0.001			
	n(%)	n(%)				
Population groups			<0.001			
Non HCWs (N=2123)	1911(90%)	212(10%)	Ref			
HCWs (N=679)	675(99.4%)	4(0.6%)	<0.001	0.189	0.119	0.300
Total	2586(92.3%)	216(7.7%)				
	Knowledge score					
	Poor	Good				
	n(%)	n(%)				
Population groups			<0.001			
Non HCWs (N=2123)	322(15.2%)	1801(84.8%)	Ref			
HCWs (N=679)	60(8.8%)	619(91.2%)	<0.001	1.845	1.380	2.466
Total	382(13.6%)	2420(86.4%)				
	Perceived barriers					
	Low perception	High perception				
	n(%)	n(%)				
Population groups			<0.001			
Non HCWs (N=2123)	1017(47.9%)	1106(52.1%)	Ref			
HCWs (N=679)	514(75.7%)	165(24.3%)	<0.005	0.295	0.243	0.359
Total	1531(54.6%)	1271(45.4%)				
	Perceived benefits		<0.001			
	Non-beneficial	Beneficial				
	n(%)	n(%)				
Population groups			<0.001			
Non HCWs (N=2123)	636(30%)	1487(69.4%)	Ref			
HCWs (N=679)	23(3.5%)	656(96.6%)	<0.001	12.199	7.967	18.679

	General population		Non HCWs		HCWs	
Total	659(23.5%)	2143(76.5%)				
	Cues to action					
	No	Yes	<0.001			
Population groups	n(%)	n(%)				
Non HCWs(N=2123)	1127(72.4%)	430(27.6%)	Ref			
HCWs(N=679)	996(80%)	249(20%)	<0.001	1.321	1.121	1.845
Total	2123(75.7%)	679(24.3%)				
	Willingness to vaccinate					
Population groups			<0.001			
Non HCWs (N=2123)	1126(53%)	997(47%)	Ref			
HCWs (N=679)	232(34.2%)	447(65.8%)	<0.001	12.199	7.967	18.679
Total	1358(48.5%)	1444(51.5%)				
N frequency, % percentage, OR Odds Ratio, 95% CI : 95% Confidence interval						

Table 4: Determinants of willingness to get COVID-19 vaccine among the general population, non HCWs and HCWs						
	General Population		Non-HCWs		HCWs	
	P-value	aOR, 95% C.I	P-value	aOR, 95% C.I	P-value	aOR, 95% C.I
Gender	<0.001		<0.001		0.127	
Male	Ref		Ref			
Female	<0.001	0.569 (0.466-0.691)	<0.001	0.496(0.391-0.630)		
Marital status	<0.001		<0.001		0.037	
Single	Ref		Ref		Ref	
Married	<0.001	1.770(1.466-2.121)	<0.001	1.50(1.270-1.966)	0.047	1.182(1.068-1.820)
Other (Divorced, Widowed)	0.386	0.820(0.525-1.283)	0.119		0.04	0.308(0.100-0.948)
Religiosity	<0.001		<0.001		0.123	
Not important/ slightly important	Ref		Ref			
Important or very important	<0.001	0.598(0.498-0.718)	<0.001	0.274(0.217-0.347)		
Age (years)	0.018		0.046		0.031	
18-29	Ref		Ref		Ref	
30-49	0.042	1.583(1.321-2.069)	0.032	1.263(1.21-2.069)	0.065	
50-65	0.038	1.781(1.232-1.989)	0.023	1.381(1.032-1.789)	0.038	1.781(1.232-1.989)
>65	<0.001	2.182(2.061-2.798)	<0.001	1.182(1.061-1.798)	<0.001	2.916(2.638-3.548)
Education level	0.213		0.118		0.432	
Secondary or less vs. University or above						
Urbanicity	0.015		<0.001		0.032	
Rural	Ref		Ref		Ref	
Urban	0.010	3.062(1.883-4.091)	<0.001	3.421(2.884-3.952)	0.041	1.865(1.371-2.544)
Personal history of COVID-19 diagnosis	0.188		0.231		0.068	
No vs. Yes						
Health status	0.322		0.210		0.417	

Table 4: Determinants of willingness to get COVID-19 vaccine among the general population, non HCWs and HCWs						
Fair or Below vs. good and above						
Family member diagnosed COVID19	0.088		0.079		0.225	
No vs. Yes						
Received vaccination against influenza in the current season	<0.001		<0.001		<0.001	
No	Ref		Ref		Ref	
Yes	<0.001	1.709(1.378-2.120)	<0.001	1.963(1.460-2.638)	0.017	1.675(1.436-2.044)
Refusal of a type of vaccine in the past	<0.001		<0.001		0.03	
No	Ref		Ref		Ref	
Yes	<0.001	0.545(0.435-0.683)	<0.001	0.595(0.451-0.785)	0.001	0.418(0.252-0.692)
Knowledge score	<0.001		<0.001		0.696	
Poor	Ref		Ref			
Good	<0.001	1.793(1.374-2.341)	<0.001	1.899(1.382-2.608)		
Perceived susceptibility	<0.001		<0.001		0.003	
Non-susceptible	Ref		Ref		Ref	
Susceptible	0.001	1.560(1.191-2.043)	<0.001	1.948(1.450-2.615)	<0.001	1.732(1.321-2.094)
Perceived severity	0.381		0.403		0.223	
Non-severe vs severe						
Concern about the side effects of the vaccine	<0.001		0.002		<0.001	
Disagree	Ref		Ref		Ref	
Agree	0.001	0.586(0.424-0.810)	0.001	0.631(0.403-0.878)	0.002	0.383(0.210-0.698)
Concern about the safety of the vaccine	<0.001		<0.001		0.039	
Disagree	Ref		Ref		Ref	
Agree	<0.001	0.417(0.28-0.606)	<0.001	0.243(0.170-0.347)	0.013	0.618(0.409-0.713)
Concern about accessibility to vaccines	<0.001		<0.001		0.012	
Disagree	Ref		Ref		Ref	

Table 4: Determinants of willingness to get COVID-19 vaccine among the general population, non HCWs and HCWs						
Agree	<0.001	1.996(1.585-2.513)	<0.001	1.810(1.375-2.382)	<0.001	1.937(1.154-3.250)
Concern about the availability of COVID-19 vaccine in limited quantities for limited categories of the population	<0.001		<0.001		<0.001	
Disagree	Ref		Ref		Ref	
Agree	<0.001	2.399(1.905-3.019)	<0.001	2.334(1.720-3.168)	<0.001	2.737(1.807-4.144)
Concern about the reliability of the manufacturer and the source of supply	<0.001		<0.001		0.121	
Disagree	Ref		Ref			
Agree	<0.001	0.624(0.497-0.784)	<0.001	0.568(0.425-0.758)		
Concern about immunity duration	0.012		0.168		<0.001	
Disagree	Ref				Ref	
Agree	0.019	0.755(0.597-0.955)			0.001	0.461(0.293-0.725)
Benefits	<0.001		<0.001		0.008	
Non Beneficial	Ref		Ref		Ref	
Beneficial	<0.001	4.577(3.323-6.303)	<0.001	6.050(4.225-8.602)	0.002	3.427(2.886-5.108)
Taking COVID-19 vaccine if recommended by a family member	0.034		0.042		0.321	
Disagree	Ref		Ref			
Agree	0.012	1.539(1.098-2.157)	0.023	1.550(1.063-2.259)		
Taking COVID-19 vaccine if recommended by the health authorities	0.032		0.001		0.038	
Disagree	Ref		Ref			
Agree	0.028	1.66(1.457-1.995)	0.005	1.550(1.063-2.259)	0.012	1.612(1.341-1.978)
Taking COVID-19 vaccine if the vaccine is taken by many in the public	0.038		0.049		0.412	
Disagree	Ref		Ref			
Agree	0.047	1.402(1.009-1.985)	1.238	1.302(1.145-1.852)		

Table 4: Determinants of willingness to get COVID-19 vaccine among the general population, non HCWs and HCWs				
Doing things on my own to improve my health	<0.001		<0.001	0.221
No	Ref		Ref	
Yes	<0.001	1.481(1.346-1.669)	<0.001	1.449(1.308-1.656)
N frequency, % percentage, HCW Health care worker, Non-HCW Non health care worker, OR Odds, CI confidence interval				

Determinants of acceptance of COVID-19 vaccine among HCWs and non-HCWs

The willingness to get COVID-19 vaccine was positively associated with sociodemographic variables such as older age, being married and living in an urban area, with past immunization behavior like receiving influenza vaccine for the current year, higher perception of susceptibility and benefits, concerns related to availability and accessibility of vaccines and recommendation of vaccine from health authorities. Married non-HCWs were 1.5 times more willing to vaccinate than single (aOR=1.5, 95% C.I (1.270-1.966)). Similarly, married individuals among HCWs were more likely to get vaccinated (aOR=1.182, 95% C.I) comparing to single HCWs. HCWs and non-HCWs who were vaccinated against influenza in the current year were more than 1.5 times more willing to get vaccinated against COVID-19. Similarly, HCWs (aOR=1.732, CI 95% (1.321-2.094)) and non-HCWs (aOR=1.948, 95% CI (1.450-2.615)) who perceived themselves susceptible for COVID-19 and who perceived vaccine benefits were more likely to get vaccinated compared to their counterparts.

However, HCWs and non-HCWs who had a history of vaccine refusal, and who were concerned about vaccine safety and side effects were less likely to get vaccinated compared to their counterparts.

On the other hand, females non-HCWs (aOR=0.496(0.391-0.631)) expressed lower intention to get vaccinated than males. Non-HCWs who acknowledged the importance of religiosity (aOR=0.274, 95% CI 0.217-0.314) in their life were less likely to get vaccinated which is not the case for HCWs.

Despite that good knowledge level was associated with higher COVID-19 vaccination intent among non-HCWs (aOR=1.899, 95% CI (1.382-2.608)), no significant association was found between this willingness and the Knowledge score (p=0.696) among HCWs

However, living in rural area (aOR=0.606, 95%CI (0.440-0.836)), personal history of COVID-19 (aOR=0.695, 95%CI (0.470-1.029), novelty of vaccine (aOR=0.424, 95% CI (0.255-0.706)), side effects (aOR=0.413, 95%CI (0.234-0.731), reliability of manufacturer (aOR=0.434, 95% CI (0.297-0.633) and vaccine frequency (aOR=0.580, 95% CI (0.403-0.836) were negatively associated with their willingness to take it. Remarkably, limited availability (aOR=2.161, 95% CI (1.461-3.197) and accessibility (aOR=1.680, 95% CI (1.141-2.474) to the vaccine were also positively associated with its uptake. Similarly, HCWs who perceived vaccine benefits were more likely to get vaccinated (aOR=11.048, 95% CI (7.993-15.269)). With regards to cues of action, having reliable and adequate information regarding the vaccine (aOR=1.979, 95% CI (1.361-2.878)), recommendation by health authorities (aOR=1.976, 95% CI(1.343-2.908)) or health facilities (aOR=2.684, 95% CI(1.804-3.994)) were positively linked to vaccine acceptance, whilst recommendation by family members (aOR=0.479, 95% CI(0.283-0.811)) was negatively related to it. Non -HCWs who are triggered by high COVID-19 vaccine intake by the public and those who received a recommendation to get vaccinate from family members were

more likely to get vaccinated. Similarly, non-HCWs who did their own things to improve their health were more likely to accept the vaccine. Of note, these factors were not significantly associated with willingness among HCWs (Table 4).

Discussion

The present study was conducted in Lebanon, prior to the initiation of the COVID-19 vaccines program, to examine the COVID-19 vaccine acceptance rates and the determinants of the HCWs and non-HCWs' intention to receive the future COVID-19 vaccine. To the best of our knowledge, this is the first study to assess HCWs and non-HCWs' willingness to vaccinate against COVID-19 and to explore if there is any difference between the determinants of this willingness among these 2 groups, based on an integrative model combining the HBM constructs, the sociodemographic characteristics, the health related-variables, the previous vaccination behavior and the intention to vaccinate.

The results of the present study showed that the overall intention to receive a COVID-19 vaccine among Lebanese population was moderate (51.5%). This finding comes in consistency with the results of studies conducted in Kuwait (53.1%) [34] and Qatar (45%-60%) [35]. However, it is higher than acceptance rate reported among Jordanian (28.4%) [25] and lower than in Saudi Arabia (64.7%) [36]. Compared to developed countries, our rate of vaccine acceptance was lower than the rates reported in United States (67%) [37], Japan (62.1%) [38], Ireland (65%) [39], and the United Kingdom (69%) [39]. However, an acceptance vaccine rate around 70% was reported by a previous survey conducted in Lebanon in April 2020 [39]. This was predicted since the study asked about a hypothetical vaccine which was not yet developed, tested or approved. On the other hand, HCWs expressed higher intention of getting vaccinated against COVID-19 than non-HCWs (65.8% vs. 47%) [39]. These results were compatible with the findings of a study conducted in China that revealed a higher vaccine uptake among HCWs compared to non-HCWs [40]. This low vaccination rate among non-HCWs should drive the Lebanese government to raise awareness about the importance of vaccination in controlling the pandemic.

Our results showed that the majority of the Lebanese population perceived themselves susceptible to get infected by COVID-19 but less than 10% of them perceived the severity of the disease. Besides, most of the Lebanese adults were knowledgeable about COVID-19 and expressed positive attitude towards the benefits of vaccines. In respect of HCWs, they expressed higher perception of susceptibility to infection, higher perception of vaccine benefits and higher compliance to cues to action than non-HCWs. Compared to non-HCWs, they had a higher knowledge score and a lower perception of barriers and disease severity.

In terms of sociodemographic characteristics associated with COVID-19 vaccine acceptance, our findings showed that the willingness to vaccinate was lower in females among the general population and the non-HCWs group. Several studies conducted in different countries such as France [41], Australia [42], UK [43], and the US [44] showed that females were more prone to be reluctant towards COVID-19 vaccination than males. This could be related to the fear instigated by the novelty and uncertainty of the vaccine in addition to its possible side effects. In addition, older age was positively associated with higher tendency to get vaccinated among HCWs and non-HCWs. Our findings are generally compatible with the results of studies conducted globally and in the neighboring countries. However, Kuwait and Qatar, showed an increased trend in hesitancy in older populations [34, 45]. Regarding the factors associated with willingness to get vaccinated against COVID19 among HCWs, consistently with our findings, a study showed that older subjects (above 60 years of age) were more willing to get vaccinated [46].

Our findings showed also that being married compared to single was significantly associated with higher odds of intention to get vaccinated among HCWs and non-HCWs. Our results were comparable to the findings of a study conducted in China [47]. Given that vaccine could reduce COVID-19 complications and since married individuals hold

the responsibility to protect themselves and their families from COVID-19 infection, hence they showed a higher tendency to adopt preventive measures such as vaccination against COVID-19.

In addition, living in urban was also associated with higher willingness to vaccinate comparing to subjects living in rural areas. Hence, vaccine hesitancy in rural areas constitute a major barrier which potentially hampering the progress toward ending the pandemic. Health authorities are urged to address vaccine hesitancy among people residing in rural areas to achieve vaccination equity.

Regarding individuals' health status and experiences with COVID-19, our study showed that a previous infection by COVID-19 or infection of a close contact (colleague, friend, family member..) as well as health status didn't affected significantly the vaccine acceptance. Our findings were consistent with the result of a meta-analysis that found that neither personal history of infection nor history of infection in a close contact were consistently associated with vaccine acceptance [48].

Concerning past vaccine behavior, vaccinations against seasonal influenza in the current year were correlated with the decision to get vaccinated against COVID-19 among both HCWs and non-HCWs. Our results were consistent with previous studies that explored the COVID-19 vaccine uptake among the general public [49]. However, a previous history of vaccine refusal was associated with lower odds of willingness to vaccinate.

The current study also revealed that the HBM domains including perception of susceptibility, benefits, cues to action and barriers were found to be significant determinants of the intention to receive a COVID-19 vaccine among HCWs and non-HCWs. A study conducted among HCWs in Asia showed that susceptibility was considered an important factor influencing the intention of getting vaccinated against COVID-19 [50].

In terms of cues to action our study showed that HCWs and non-HCWs were more motivated to get vaccinated if this is recommended by health authority. Several cues to action have been found to encourage non-HCWs such as the recommendation of vaccine by a family member or when a large proportion of the public received the vaccine. Previous studies mentioned that some individuals including HCWs refused to be vaccinated in the first round and would prefer to wait and see if there is any side effects [51]. Hence, there is need that health authorities issued recommendations for COVID-19 vaccine and raised awareness in order to build confidence towards new vaccine in order to encourage both HCWs and non HCWs to get vaccinated. Several studies highlighted the importance of internal or external triggers, particularly encouragement in improving intention of getting vaccinated especially in the context of influenza [52].

Our study also revealed that HCWs and non-HCWs that had high perceived benefits of COVID-19 vaccine were more likely to get vaccinated. Keeping positive attitudes towards the benefits of COVID-19 vaccine in terms of protecting themselves and others is crucial particularly for HCWs as they serve as a role model to patients. This finding is consistent with previous studies showing that positive attitude toward the vaccine play an important role in the vaccine uptake [53].

In terms of barriers, concerns reported by HCWs and non-HCWs regarding the safety of vaccine and side effects were associated with lower odds of intentions of getting vaccinated. Our results were comparable to those reported in previous studies [54]. HCWs expressed other concern concerning the duration of immunity that affect negatively their willingness to vaccinate. Given that there was a lack of social information regarding the effectiveness, safety and quality of the COVID-19 vaccine at the time of conducting this study, non-HCWs reported a higher level of concerns about reliability of manufacturer than did medical HCWs.

Our findings highlight the importance of public awareness measures and vaccination campaigns that address the safety of the vaccine to lessen concerns about vaccine safety and efficacy rather than discussing the severity of the

disease. Repeated assessments of COVID-19 vaccine uptake, are recommended since perceptions and concerns may be changing rapidly over time. Given the large number of refugees in Lebanon and their multiple vulnerabilities, future studies targeting vaccination among refugees in Lebanon are needed.

Limitations

Several limitations in this study should be acknowledged. The cross-sectional design of the study does not allow us to infer causality. Selection bias is possible due to the snowball technique that was used to collect data which limits the generalizability of the findings. The collected data was based on self-reported information which makes it prone to social desirability. Recall bias could have occurred particularly for the questions related to past behavior. In addition, the study was conducted before the vaccine was available and information on vaccine efficiency and safety at that point were not accurate. Thus, the actual vaccine uptake against COVID-19 could change once the vaccine becomes available.

Conclusion

Lebanese adults have a moderate overall acceptance of COVID-19, and HCW are more willing to be vaccinated than non-HCWs. To control COVID-19 effectively, efforts targeting the modifiable factors driving moderate COVID-19 vaccine acceptance are required to increase acceptance rate among the Lebanese population.

Declarations

Author Contributions:

D.Y. was involved with study conception and design, data collection and analysis, drafted and revised the manuscript. O.I. and L.A.A were involved in data collection and analysis and revising the article. J.Y was involved with study conceptualization and design, drafting and revising the article. H.S was involved in the study conceptualization and the revision of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement:

Informed consent for participating in the study was obtained digitally through Google Forms from all subjects, and all methods were carried out in accordance with the relevant guidelines and national regulations for the Non-clinical studies. Specifically, at the beginning of the questionnaire, participants were asked whether they agree to participate in the research and whether they were 18 years old or older to be included in the study. Only participants who answered these two questions positively were able to continue with the questionnaire. Participants were also informed that their participation was voluntary and that they had the right to leave at any time without providing any explanation. No incentives were provided to the study participants.

Data Availability Statement:

The datasets generated during the current study are not publicly available but are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no competing interests and they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Consent for publication

Not applicable.

Abbreviations

COVID-19

Coronavirus disease 2019

Sars-Cov2

Severe acute respiratory syndrome-Coronavirus2

HBM

Health Belief Model;

HCWs

Healthcare Workers;

MOPH

Ministry of Public Health

UK

United Kingdom

USA

United States of America

SPSS

Statistical package for social sciences

OR

odds ratio

aOR

adjusted odds ratio

C.I

Confidence interval

References

1. Yang X, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *The Lancet Respiratory Medicine*. 2020;8(5):475–81.
2. *World Health Organization (WHO) Coronavirus Disease (COVID-19) Dashboard*. Available online: https://covid19.who.int/?gclid=EAlaIqObChMI2_CM6eDZ6gIVghh9Ch3nDQm1EAAAYASAAEgLqwPD_BwE. Accessed on 17 July 2020.

3. World. *Health Organization WHO Director-General's Opening Remarks at the Media Briefing on COVID-19—11 March*. Available online: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020>. Accessed on 13 April 2020..
4. Lin Y, et al. Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China. *PLoS Negl Trop Dis*. 2020;14(12):e0008961.
5. *World Health Data Platform. Draft Landscape and Tracker of COVID-19 Candidate Vaccines*. Available online at <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines> accessed March 15, 2021.
6. Zhang KC, et al. Parental acceptability of COVID-19 vaccination for children under the age of 18 years: cross-sectional online survey. *JMIR pediatrics parenting*. 2020;3(2):e24827.
7. Randolph HE, Barreiro LB. Herd immunity: understanding COVID-19. *Immunity*. 2020;52(5):737–41.
8. Verity R, et al., *S.[van Elsland], E. Volz, H. Wang, Y. Wang, X. Xi, CA Donnelly, AC Ghani, NM Ferguson*, Estimates of the severity of coronavirus disease, 2019: p. 30243-7.
9. Lurie N, et al. Developing Covid-19 vaccines at pandemic speed. *N Engl J Med*. 2020;382(21):1969–73.
10. Yang Y, et al., *The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China, 5 2020*. *J. Autoimmun.* 102434.
11. *Pfizer. and Biontech achieve first authorization in the world for a vaccine to combat COVID-19*. Available at <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-achieve-first-authorization-world>. Accessed 23 January 2021.
12. Forni G, Mantovani A. COVID-19 vaccines: where we stand and challenges ahead. *Cell Death Differentiation*. 2021;28(2):626–39.
13. Friedrich M. WHO's top health threats for 2019. *Jama*. 2019;321(11):1041–1.
14. Jarrett C, et al. *SAGE Working Group on Vaccine Hesitancy*. Strategies for addressing vaccine hesitancy—A systematic review. *Vaccine*. 2015;33(34):4180–90.
15. Malik AA, et al. Determinants of COVID-19 vaccine acceptance in the US. *EClinicalMedicine*. 2020;26:100495.
16. Murphy J, et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat Commun*. 2021;12(1):29.
17. Maltezou HC, et al. Vaccination of healthcare workers: is mandatory vaccination needed? *Expert Rev Vaccines*. 2019;18(1):5–13.
18. Wang K, et al. Intention of nurses to accept coronavirus disease 2019 vaccination and change of intention to accept seasonal influenza vaccination during the coronavirus disease 2019 pandemic: A cross-sectional survey. *Vaccine*. 2020;38(45):7049–56.
19. Ng TW, et al. Testing an integrative theory of health behavioural change for predicting seasonal influenza vaccination uptake among healthcare workers. *Vaccine*. 2020;38(3):690–8.
20. Maltezou HC, et al. Determinants of intention to get vaccinated against novel (pandemic) influenza A H1N1 among health-care workers in a nationwide survey. *J Infect*. 2010;61(3):252–8.
21. Rosenstock IM. The health belief model and preventive health behavior. *Health education monographs*. 1974;2(4):354–86.
22. *World Health Organization (WHO). Keep health workers safe to keep patients safe: WHO*. Available at <https://www.who.int/news/item/17-09-2020-keep-health-workers-safe-to-keep-patients-safe-who>. Accessed on 23 January 2021.

23. Ministry of Public Health. *Novel Coronavirus 2019. COVID-19 surveillance in Lebanon*. Available at: <https://www.moph.gov.lb/en/Pages/2/24870/novel-coronavirus-2019->. Accessed on 3 March 2021.
24. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*. 2015;33(34):4161–4.
25. Alhalaseh L, Fayoumi H, Khalil B. The Health Belief Model in predicting healthcare workers' intention for influenza vaccine uptake in Jordan. *Vaccine*. 2020;38(46):7372–8.
26. Jones CL, et al. The health belief model as an explanatory framework in communication research: exploring parallel, serial, and moderated mediation. *Health communication*. 2015;30(6):566–76.
27. Beaton DE, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25(24):3186–91.
28. Myers LB, Goodwin R. Determinants of adults' intention to vaccinate against pandemic swine flu. *BMC Public Health*. 2011;11(1):1–8.
29. Coe AB, Gatewood SB, Moczygemba LR, *The use of the health belief model to assess predictors of intent to receive the novel (2009) H1N1 influenza vaccine*. *Innovations in pharmacy*, 2012. 3(2): p. 1.
30. Guidry JP, et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am J Infect Control*. 2021;49(2):137–42.
31. Youssef D, et al., *Determinants of Acceptance of Coronavirus Disease-2019 (COVID-19) Vaccine Among Lebanese Health Care Workers Using Health Belief Model*. 2021.
32. Schmidt SA, Lo S, Hollestein LM. Research techniques made simple: sample size estimation and power calculation. *Journal of Investigative Dermatology*. 2018;138(8):1678–82.
33. Jiang Z, et al., *International Journal of Nursing Studies Menstrual disorders and occupational exposures among female nurses: A nationwide cross-sectional study*. 2019.
34. Alqudeimat Y, et al. Acceptance of a COVID-19 Vaccine and Its Related Determinants among the General Adult Population in Kuwait. *Medical Principles Practice*. 2021;30(3):262–71.
35. Sallam M, et al. High rates of COVID-19 vaccine hesitancy and its association with conspiracy beliefs: A study in Jordan and Kuwait among other Arab countries. *Vaccines*. 2021;9(1):42.
36. Al-Mohaithef M, Padhi BK. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey. *Journal of multidisciplinary healthcare*. 2020;13:1657.
37. Malik A, et al., *Determinants of COVID-19 vaccine acceptance in the US*. *EClinicalMedicine*. 2020; 26: 100495. 2020, Epub 2020/08/25. <https://doi.org/10.1016/j.eclinm.2020.100495> PMID: 32838242.
38. Machida M, et al. Acceptance of a COVID-19 Vaccine in Japan during the COVID-19 Pandemic. *Vaccines*. 2021;9(3):210.
39. Murphy J, et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature communications*. 2021;12(1):1–15.
40. Wang M-W, et al., *COVID-19 Vaccination Acceptance Among Healthcare Workers and Nonhealthcare Workers in China: A Survey*. Available at SSRN 3816767, 2021.
41. Gagneux-Brunon A, et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect*. 2021;108:168–73.
42. Rhodes A, et al. Intention to vaccinate against COVID-19 in Australia. *Lancet Infect Dis*. 2021;21(5):e110.
43. Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. *The Lancet Regional Health-Europe*. 2021;1:100012.
44. Loomba S, Figueiredo A de, Piatek SJ, Graaf K de, Larson HJ. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nature Human Behaviour*, 2021.

45. Alabdulla M, et al. COVID-19 vaccine hesitancy and attitudes in Qatar: A national cross-sectional survey of a migrant-majority population. *Influenza Other Respir Viruses*. 2021;15(3):361–70.
46. Unroe KT, et al. Willingness of Long-Term Care Staff to Receive a COVID-19 Vaccine: A Single State Survey. *J Am Geriatr Soc*. 2021;69(3):593–9.
47. Wang J, et al. Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. *Vaccines*. 2020;8(3):482.
48. Lin C, Tu P, Beitsch LM. Confidence and receptivity for COVID-19 vaccines: a rapid systematic review. *Vaccines*. 2021;9(1):16.
49. Sherman SM, et al., COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. *Human vaccines & immunotherapeutics*, 2021. 17(6): pp. 1612–21.
50. Chew NW, et al. An Asia-Pacific study on healthcare workers' perceptions of, and willingness to receive, the COVID-19 vaccination. *International Journal of Infectious Diseases*. 2021;106:52–60.
51. Dror AA, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol*. 2020;35(8):775–9.
52. Hopman C, et al. Determination of factors required to increase uptake of influenza vaccination among hospital-based healthcare workers. *J Hosp Infect*. 2011;77(4):327–31.
53. Corace KM, et al. Using behavior change frameworks to improve healthcare worker influenza vaccination rates: a systematic review. *Vaccine*. 2016;34(28):3235–42.
54. Godin G, Vézina-Im L-A, Naccache H. Determinants of influenza vaccination among healthcare workers. *Infection Control Hospital Epidemiology*. 2010;31(7):689–93.

Figures

Figure 1

Willingness to get COVID-19 vaccine once available in Lebanon