

COVID-19 Vaccination Coverage and Female Healthcare Workers: A Look at the Gender Gap

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Abstract

Background

Females are often more hesitant to get vaccinated than males, even among health care workers (HCWs). The purpose of this study was to assess female HCWs' COVID-19 vaccination coverage and their anti-vaccination attitudes.

Methods

We conducted a cross-sectional study using an online questionnaire. It included HCWs from various professions and examined participants' sociodemographic and work-related variables, anti-vaccination attitudes, and COVID-19 vaccination uptake. Anti-vaccination attitudes were assessed using the Vaccination Attitudes Examination Scale. We computed vaccination coverage and assessed its predicting factors using descriptive and analytical statistics, including multivariable models.

Results

The vaccine coverage was significantly lower among female HCWs [59.6% (95%CI: 55.5%-63.7%)] than males [74.9% (95%CI: 70.7%-78.8%)]. Female HCWs had significantly higher anti-vaccination attitudes and lowered perceived COVID-19 vaccine knowledge. Vaccine uptake was shown to be age-related in female HCWs, with 52.7% in the less than 30-year age group and 70.7% in the ≥ 50 -year age group. Higher monthly income and smoking status were significant predictors of female HCWs vaccine uptake.

Conclusions

vaccine coverage is significantly lower among females with higher anti-vaccination attitudes. Historical scepticism towards vaccination, mistrust of the medical literature, and the myth of infertility could be possible reasons.

Background

COVID-19 has quickly escalated into a major public health catastrophe, affecting millions of people and resulting in millions of deaths worldwide. Apart from implementing social distancing measures, it is critical to establish a high vaccination coverage to prevent disease and death [1].

The race to develop COVID-19 vaccines was recognized early on that it would not be enough to stop the pandemic unless the public widely accepted the vaccine. COVID-19 vaccination hesitancy has been extensively studied, with significant variation in willingness to be vaccinated across communities [2].

Males, older adults, persons of different racial and cultural backgrounds, and college and/or graduate degree holders are more likely to accept the vaccine if it is advised for them [3].

Healthcare workers (HCWs) on the front lines contribute to the nation's fight against COVID-19, so issues like vaccine acceptance and coverage should be taken seriously. HCWs, who are likely to be the most knowledgeable about COVID-19 morbidity and mortality issues, are more likely than others to accept the vaccine, according to expectations. While it is recommended that all HCWs get vaccinated, gender differences in vaccine acceptance and uptake have been documented. A scoping review providing a comprehensive global assessment of published evidence on COVID-19 vaccine hesitancy among HCWs found that male HCWs were more likely to receive the vaccine [4–6]. Males were three times more likely than females in Palestine to accept the COVID-19 vaccine [7].

This gender disparity could be due to a variety of factors. Although there have been numerous media debates about fertility concerns, data from clinical trials also addressed whether the COVID-19 vaccines harm fertility [8, 9], with sparse but reassuring results. Even though a new expert guidance report states that there is “absolutely no evidence” that the COVID-19 vaccine affects women's or men's fertility, there are numerous blatant falsehoods on social media that the vaccine affects younger people women's fertility [10].

Despite numerous studies assessing vaccination intentions around the world, few studies have evaluated actual HCW vaccination uptake. Furthermore, our study may be the first to look at COVID-19 vaccination uptake by gender, focusing on female HCWs, to identify the factors that keep them from receiving the vaccine. The study's objectives are to (a) determine the proportion of female and male HCWs who received the COVID-19 vaccine, (b) compare anti-vaccination attitudes between female and male HCWs, and (c) identify predictors of COVID-19 vaccine uptake. The study's findings will assist policymakers and healthcare administrators develop protocols, policies, and interventions to promote vaccination uptake among female HCWs at their workplace. In addition, this study will serve as the foundation for future analytical studies to evaluate the impact of various interventions on addressing barriers and anti-vaccination attitudes among HCWs.

Methods

Study design and participants

This study used data collected as part of another study assessing vaccine coverage among all HCWs (unpublished yet). We used an anonymous online questionnaire to conduct this cross-sectional study. We targeted HCWs of different professions; physicians, nurses, and allied healthcare personnel in hospitals and primary health care centres. A convenience sampling technique utilizing Google forms were implemented to collect responses. Raosoft software was used to compute sample size using a 95% confidence level, a 50% prevalence estimate, and a 3% margin error. The sample size of 1024 was calculated.

Measurement Tool and variables

An online Google Form based on a pre-designed questionnaire was created and sent to the HCWs' personal accounts via social media, email, or other online systems. We sent the survey with an invitation message that explained the study's purpose and a consent form. It started with a mandatory question about whether or not the HCW wanted to participate. A second reminder was issued to healthcare workers to remind them to complete the online questionnaire that they hadn't filed. The data were collected between the months of April and June 2021.

The questionnaire was made up of three parts: the first part consisted of questions about sociodemographic and work-related characteristics. The variables were chosen in light of the available literature and investigator input. HCWs were asked about their age, gender, marital status, job title, employment, having a child, years of experience, smoking status, physical activity, and monthly income. The second part explored HCWs' anti-vaccination attitudes using the Vaccination Attitudes Examination (VAX) Scale adjusted to the COVID-19 vaccine. It has 12 items and sub-categorized into four sub-scales: (1) mistrust of vaccine benefits, (2) worries over unforeseen future effects, (3) concerns about commercial profits, (4) preference for natural immunity. It is a self-reported measure that has been validated in HCWs and takes 5 to 7 minutes to administer. Each item's score ranges from 1 (strongly agree) to 5 (strongly disagree), except for sub-scale #1, which has a coding range of 1 (strongly disagree) to 5 (strongly agree). A higher overall score indicates that HCWs have more negative attitudes toward COVID-19 vaccination. Previous research [11] has shown a high level of internal consistency. The authors of this study translated the VAX scale into Arabic, and a native English speaker checked the back-translation. Cronbach's alpha was calculated to determine the scale's internal consistency for this study, which was 0.83.

The third part assessed the study's primary outcome variable, COVID-19 vaccine coverage (vaccinated vs unvaccinated). This part also inquired about other COVID-19 vaccine variables such as the type, the number of doses received side effects, perceived COVID-19 knowledge, and vaccine knowledge.

The questionnaire validation (face and content validity) was carried out by a panel of experts, including one family physician, a community medicine consultant, and a public health consultant. Then, we conducted an online pilot study with 30 HCWs to assess its clarity, understanding, and feasibility. Participants in the pilot study were excluded from the larger sample.

Analysis Plan

The statistical analysis was performed using IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, NY, USA). Frequency distribution was used to summarize the categorical variables. The normal distribution of continuous variables was assessed using the Kolmogorov-Smirnov test. Categorical variables were expressed as frequencies and percentages. Univariate analyses and cross-tabulation were used to determine differences between groups, using the Chi-square test and the Mann-Whitney U test, as appropriate. Multivariable analyses using binary regression were used to identify factors that are

independently associated with vaccination uptake. Results were considered statistically significant at a p-value \leq of 0.05.

The study obtained ethical approval from the Institutional Review Board (IRB) of **[Blank for blind review]** (Ref #: Med. March. 2021/23). Before beginning the online survey, all participants were informed about the study's purpose, and their participation was entirely voluntary. Using a web-based survey method allowed respondents to remain anonymous; when returning the questionnaire, web-based tools protect information confidentiality and prevent other participants from accessing it. Moreover, we didn't include identifying questions in the survey.

Results

Background characteristics

A total of 1018 HCWs participated in this study; 560 females (55%) and 458 males (45%). Table 1 presents the sociodemographic characteristics of the participants by gender. Almost 40% of female and male HCWs were under the age of 30. Nurses account for 34.5% of female HCWs, whereas physicians comprise the majority of male HCWs. Almost two-thirds of both male and female HCWs were married and had children, and the majority worked in the government sector.

Table 1

Participants' background and demographic characteristics and it relates to vaccine uptake by gender

<i>Characteristic</i>	Female Health care workers (n=560)			Male Health care workers (n=458)		
	Total n(%)	<i>Unvaccinated</i>	<i>Vaccinated</i>	Total n(%)	<i>Unvaccinated</i>	<i>Vaccinated</i>
Age group						
< 30 years	220 (39.3%)	104 (47.3%)	116 (52.7%)	175 (38.2%)	31 (17.7%)	144 (82.3%)
30-39 years	209 (37.3%)	81 (38.8%)	128 (61.2%)	128 (27.9%)	36 (28.1%)	92 (71.9%)
40-49 years	90 (16.1%)	29 (32.2%)	61 (67.8%)	112 (24.5%)	33 (29.5%)	79 (70.5%)
≥ 50 years	41 (7.3%)	12 (29.3%)	29 (70.7%)	43 (9.4%)	15 (34.9%)	28 (65.1%)
P-value		.027			.029	
Profession						
Physicians	180 (32.1%)	68 (37.8%)	112 (62.2%)	258 (56.3%)	47 (18.2%)	211 (81.8%)
Nurses	193 (34.5%)	76 (39.4%)	117 (60.6%)	99 (21.6%)	34 (34.3%)	65 (65.7%)
Others*	187 (33.4%)	82 (43.9%)	105 (56.1%)	187 (22.1%)	34 (33.7%)	67 (66.3%)
P-value		.467			.001	
Marital status						
Married	372 (66.4%)	156 (41.9%)	216 (58.1%)	313 (68.3%)	93 (29.7%)	220 (70.3%)
Single	188 (33.6%)	70 (37.2%)	118 (62.8%)	145 (31.7%)	22 (15.2%)	123 (84.8%)
P-value		.284			.001	
Monthly income (N/S)						
<4000	319 (57.0%)	158 (49.5%)	161 (50.5%)	225 (49.1%)	71 (31.6%)	154 (68.4%)
4000- <6000	205 (36.6%)	59 (28.8%)	146 (71.2%)	156 (34.1%)	31 (19.9%)	125 (80.1%)

<i>Characteristic</i>	Female Health care workers (n=560)			Male Health care workers (n=458)		
	Total n(%)	<i>Unvaccinated</i>	<i>Vaccinated</i>	Total n(%)	<i>Unvaccinated</i>	<i>Vaccinated</i>
≥6000	36 (6.4%)	9 (25.0%)	27 (75.0%)	77 (16.8%)	115 (25.1%)	343 (74.9%)
P-value		<.001			.007	
Health care setting						
Governmental	409 (73.0%)	173 (42.3%)	236 (57.7%)	336 (73.4%)	97 (28.9%)	239 (71.1%)
Non-Governmental	151 (27.0%)	53 (35.1%)	98 (64.9%)	122 (26.6%)	18 (14.8%)	104 (85.2%)
P-value		.123			.002	
Patients contact per day						
< 30 patients	280 (50.0%)	110 (39.3%)	170 (60.7%)	270 (58.9%)	72 (26.7%)	198 (73.3%)
30-50 patients	135 (24.1%)	57 (42.2%)	78 (57.8%)	91 (19.9%)	17 (18.7%)	74 (81.3%)
≥50 patients	145 (25.9%)	59 (70.7%)	86 (59.3%)	97 (21.2%)	26 (26.8%)	71 (73.2%)
P-value		.846			.287	
Smoking						
Non-smoker	470 (83.9%)	198 (42.1%)	272 (57.9%)	256 (55.9%)	75 (29.3%)	181 (70.7%)
Smoker	90 (16.1%)	28 (31.1%)	62 (68.9%)	202 (44.1%)	40 (19.8%)	162 (80.2%)
P-value		.050			.020	
Physical activity						
No	245 (43.8%)	98 (40.0%)	147 (60.0%)	179 (39.1%)	48 (26.8%)	131 (73.2%)
Yes- irregular	286 (51.1%)	120 (42.0%)	166 (58.0%)	243 (53.1%)	53 (21.8%)	190 (78.2%)
Yes- regular	29 (5.2%)	8 (27.6%)	21 (72.4%)	36 (7.9%)	14 (38.9%)	22 (61.1%)

<i>Characteristic</i>	Female Health care workers (n=560)			Male Health care workers (n=458)		
	Total n(%)	Unvaccinated	Vaccinated	Total n(%)	Unvaccinated	Vaccinated
P-value		.070			.319	
Chronic disease						
No	78 (14.0%)	195 (70.7%)	284 (59.3%)	78 (17.0%)	91 (24.1%)	286 (75.9%)
Yes	479 (86.0%)	30 (38.5%)	48 (61.5%)	377 (82.3%)	22 (28.2%)	56 (71.8%)
P-value		.707			.449	
Living with a child						
No	199 (35.5%)	64 (32.2%)	135 (67.8%)	151 (33.0%)	32 (21.2%)	119 (78.8%)
Yes	361 (64.5%)	162 (44.9%)	199 (55.1%)	307 (67.0%)	83 (27.0%)	224 (73.0%)
P-value		.003			.175	

[Insert her Table 1]

COVID-19 vaccination attitudes and vaccine perceived knowledge

Female HCWs had significantly higher anti-vaccination attitudes and lowered perceived COVID-19 vaccine knowledge (Table 2). The VAX scale anti-vaccination scores were significantly higher for the overall score and its four subscales: mistrust of vaccine benefits, worries about unforeseen future effects, concerns about commercial profits, and preference for natural immunity; p-value <.05 for all. Compared to 60.7% of male HCWs, 49.6% of female HCWs rated their COVID-19 knowledge as very good to excellent (P-value <.001). Moreover, only 36.6% of female HCWs rated their vaccine knowledge as very high to excellent, compared to 47.8% of male HCWs (P-value <.001).

Table 2
 HCWs' attitudes towards COVID-19 vaccine and their perceived knowledge, by gender

	Female HCWs	Male HCWs	P-value*
COVID-19 vaccine attitude (Median (IQR))			
Overall attitude (total score)	37 (18-58)	35 (20-55)	<.001
<i>Mistrust of vaccine benefits</i>	8 (5-15)	6 (3-15)	<.001
<i>Worries over unforeseen future effects</i>	12 (4-15)	12 (6-9)	.018
<i>Concerns about commercial profits</i>	8 (4-15)	7 (3-15)	.014
<i>Preference to natural immunity</i>	10 (5-15)	10 (4-15)	.197
Perceived COVID-19 Knowledge			
Poor to good [†]	282 (50.4%)	180 (39.3%)	<.001
Very good to Excellent	278 (49.6%)	278 (60.7%)	
Perceived vaccine Knowledge			
Poor to good [†]	355 (63.4%)	239 (52.2%)	<.001
Very good to Excellent	205 (36.6%)	219 (47.8%)	
<i>*Mann-Whitney U test, *Chi-squared test</i>			

[Insert her Table 2]

COVID-19 vaccine coverage

The vaccine coverage was significantly lower among female HCWs [59.6% (95%CI: 55.5%-63.7%)] than male HCWs [74.9% (95%CI: 70.7%-78.8%)]. Vaccine uptake was shown to be age-related in female HCWs, with 52.7% in the <30-year age group and 70.7% in the ≥50-year age group. On the contrary, it was higher among younger male HCWs; 82.3% for the <30-year age group compared to 65.1% for the ≥50-year age group. For both female and male HCWs, higher monthly income levels and smoking were significantly related to vaccine uptake. Vaccine uptake was almost distributed equally across professions among female HCWs (56.12-62.2%), but much higher among male physicians (81.8%) than male nurses (65.7%) and others (66.3%). Furthermore, male HCWs working in non-government sectors, unmarried and smokers, reported significantly higher vaccine uptake levels (Table 1).

Antivaccination attitudes and perceived COVID-19 vaccine knowledge were also related to uptake for female and male HCWs (Table 3). Anti-vaccination attitudes were significantly higher among vaccinated male and female HCWs than among non-vaccinated groups on the overall anti-vaccination attitude scale and its four subscales; mistrust of vaccine benefits, worries about unforeseen future effects, and concerns about concerns commercial profits, and preference for natural immunity (P-value <.001). In

addition, vaccinated females and male HCWs had significantly higher perceived vaccine knowledge than non-vaccinated groups, with P-values of .003 and .052, respectively.

Table 3
 COVID-19 vaccine attitudes and perceived knowledge among female and male HCWs

Variables	Female Health care workers		Male Health care workers	
	Unvaccinated	Vaccinated	Unvaccinated	Vaccinated
Overall attitude (total score)	40 (25-58)	34 (18-55)	40 (23-55)	33 (20-50)
P-value	<.001		<.001	
<i>Mistrust of vaccine benefits</i>	8 (3-15)	6 (3-14)	8 (3-15)	6 (3-11)
P-value	<.001		<.001	
<i>Worries over unforeseen future effects</i>	12 (6-15)	11 (4-15)	12 (7-15)	11 (6-15)
P-value	<.001		<.001	
<i>Concerns about commercial profits</i>	9 (3-15)	7 (3-14)	8 (3-14)	7 (3-15)
P-value	<.001		.001	
<i>Preference to natural immunity</i>	11 (5-15)	11 (5-15)	11 (7-15)	9 (4-15)
P-value	<.001		<.001	
Perceived COVID-19 Knowledge				
Poor to good	122 (43.3%)	16 (56.7%)	51 (28.3%)	129 (71.7%)
Very good to Excellent	104 (37.4%)	174 (62.6%)	64 (23.0%)	214 (77.0%)
P-value	.158		.200	
Perceived vaccine Knowledge				
Poor to good	160 (45.1%)	195 (54.9%)	69 (28.9%)	170 (71.1%)
Very good to Excellent	66 (32.2%)	139 (67.8%)	46 (21.0%)	173 (79.0%)
P-value	.003		.052	
History of COVID-19 infection				
No	113 (33.5%)	224 (66.5%)	53 (18.7%)	231 (81.3%)
Yes	113 (50.7%)	1 (49.3%)	62 (35.6%)	112 (64.4%)
P-value	<.001		<.001	

	Female Health care workers		Male Health care workers	
A relative died of COVID-19				
No	169 (39.8%)	256 (60.2%)	88 (26.4%)	245 (73.6%)
Yes	57 (42.2%)	78 (57.8%)	27 (21.6%)	98 (78.4%)
P-value	.612		.289	
<i>*P values were calculated using the Mann-Whitney U test and Chi-squared test, as appropriate</i>				

[Insert her Table 3]

Factors associated with COVID-19 vaccine uptake

We conducted multivariate logistic regression to identify variables that predict COVID-19 vaccine uptake among HCWS (Table 4). Female HCWs who had a higher monthly income and smoked were more likely to get the vaccine, whereas previous COVID-19 infection ($p < .001$, aOR = .42, 95%CI: .30- .59), living with a child ($p < .001$, aOR = .42, 95%CI: .30- .59), mistrust of vaccine benefits ($p < .001$, aOR = .65, 95%CI: .60- .71), and concerns about unforeseen future effects ($p = .002$, aOR = .86, 95%CI: .78- .95) were associated with lower vaccination uptake.

Table 4

Logistic regression analysis of factors associated with COVID-19 vaccine among Palestinian healthcare workers

	Female Health care workers (n=560)			Male Health care workers (n=458)		
	SE	aOR (95%CI)	P	SE	aOR (95%CI)	P
Age group (ref. < 30 years)						
30-39 years	.204	1.2 (.80-1.8)	.378	.224	1.5 (.98-2.4)	.063
40-49 years	.244	1.5 (.90-2.3)	.128	.278	2.2 (1.3-3.8)	.004
≥ 50 years	.312	1.1 (.56-1.9)	.898	.341	1.7 (.87-3.3)	.119
Profession (ref. Others*)						
Physicians	--	--	--	.217	1.3 (.83-1.9)	.279
Nurses	--	--	--	.209	1.2 (.79-1.8)	.401
Marital status (ref. Married)						
Single	--	--	--	.216	1.9(1.3-2.9)	.002
Monthly income (ref. < 4000)						
4000- <6000 NIS	.182	1.7 (1.2-2.5)	.003	.186	1.7 (1.2-2.4)	.006
≥6000 NIS	.300	1.8 (1.1-3.3)	.041	.317	1.7 (.89-3.1)	.114
Health care setting (ref. Governmental)						
Non-Governmental	--	--	--	.199	1.9 (1.2-2.7)	.003
Smoking (ref. Non-smoker)						
Smoker	.189	1.6 (1.2-2.4)	.002	.191	1.7 (1.2-3.3)	.007
Living with a child (ref. No)						
Yes	.198	.61 (.41-.88)	.009	--	--	--
Perceived vaccine Knowledge ref. Poor to good)						
Very good to Excellent	.169	.87(.63-1.2)	.41	.170	(.87(.62-1.2)	.41
History of COVID-19 infection (ref. No)						
Yes	.164	.42 (.30- .59)	<.001	.165	.42 (.30- .59)	<.001
Mistrust of vaccine benefits	.041	.65(.60-.71)	<.001	.042	.65(.60-.71)	<.001
Worries over unforeseen future effects	.047	.86(.78-.95)	.002	.048	.86(.78-.95)	.002

	Female Health care workers (n=560)			Male Health care workers (n=458)		
	SE	aOR (95%CI)	P	SE	aOR (95%CI)	P
Concerns about commercial profits	.036	.96(.89-1.1)	.299	.038	.96(.90-1.1)	.241
Preference to natural immunity	.040	.97(.89-1.1)	.405	.040	.97(.89-1.1)	.414
<i>aOR= adjusted Odds Ratio, CI= confidence interval, ® Lab technicians, radiology technicians, and occupational and physiotherapists</i>						

[Insert her Table 4]

Discussion

Throughout history, females have shown a higher tendency for vaccine hesitation [12]. The historical bias against females in the scientific literature can be an integral cause as women are often more sceptical of medicine and the pharmaceutical industries[13]. Expectedly, females had a higher mistrust of the vaccine in our study. In addition, females often exhibit a more heightened responsibility sense for the family's health as a whole. Hence, they engage in medical research and consultations with experts, but they are also exposed to negative news and social media opinions [14]. Interestingly, it has been previously reported that women comprise most people with anti-vaccination tendencies on social media [15]. Therefore, these factors can interplay, among others, affecting females' negative attitudes towards vaccinations.

With the recent surge of COVID-19 and the development of vaccines, this trend has proved to be still in effect, with many studies reporting higher levels of COVID-19 vaccine concern among females and lower uptake rates [16–18]. Similarly, our study found that female HCWs have lower vaccine uptake rates than males, which is worrisome considering their substantial role in inpatient care, particularly given the high proportion of female nurses. Consequently, this study used the VAX scale and its sub-items to examine gender differences in attitudes toward vaccine uptake and other associated variables.

Gender-related issues such as infertility and pregnancy were of particular importance debating the difference between genders, while other factors such as profession and parenthood were proposed and reported as significant indicators for vaccine uptake, among others [19, 20]. The myth of infertility persists despite the lack of any evidence to support this notion[10]. A recent study exploring the factors nurturing conspiracy theories regarding COVID-19 and its implication on vaccine uptake has found that 23% of respondents believed the COVID-19 vaccines could lead to infertility [21]. While this specific concern was not addressed in this study, there was an increase in vaccine uptake with increasing age in female HCWs. In males, however, this relationship was reversed; younger males had the vaccine at a higher rate than older males. When this is connected to vaccination attitudes, we can explain this

variation in the significant difference in females' attitudes by the increased concerns about unforeseen future effects.

Many recent studies have reported profession as an essential indicator of vaccination, with physicians having higher vaccination rates [19, 20]. In this study, male physicians are higher than their female counterparts. However, contrary to the recent reports, there was no significant difference in vaccine uptake among females of different professions, with similar vaccine uptake rates between female physicians, nurses, and others. This indicates that working in higher-ranking professions, such as physicians, is not predictive of vaccine uptake but rather that gender plays a significant role. Being a female physician, nurse, or even administrative worker is associated with lower COVID-19 vaccine uptake. Hence, the reluctance of female HCWs to take the vaccine may be due to other reasons, possibly exclusive to females. Likewise, our analysis shows a significant difference between male and female HCWs' perceived knowledge of COVID-19 and its vaccine; although this gap warrants further investigation to understand its cause, it might play a big factor in driving the negative attitude of females HCWs towards vaccination against the virus.

Other studies have identified having a child as a negative predictive factor for vaccine uptake [19, 22]. Our study results indicate a similar tendency for females. The concerns for local and systemic reactions against the vaccine in most unvaccinated females might make them unsure of their ability to take care of their children under such circumstances. This comes in line with other reports that cited concerns for side effects as a significant barrier in the face of vaccination [17, 23–25].

The overall negative attitude of female HCWs towards the vaccine could be a significant obstacle for healthcare in general and the resolution of the COVID-19 pandemic in particular. To combat this devastating implication, we need to target specific concerns that support this attitude, including components explored in this study, such as worries over unforeseen future effects or concerns about commercial profits.

Despite the significant contributions made by this research, a number of limitations should be addressed. First, the generalizability of this study is limited due to its convenience-sampling approach; however, this is an exploratory study that has provided insight into the current COVID-19 vaccine uptake in HCWs based on their gender. Second, relying on an online survey to collect data may introduce non-response bias, undermining the study's generalizability. To avoid this bias, we did not require respondents to reveal their identities. Third, some potential confounders associated with female HCW vaccination uptake were not collected, such as being pregnant, planning to become pregnant shortly, or vaccination-related fertility issues. However, the VAX scale measures these issues indirectly through different items.

Conclusion

In conclusion, female HCWs had significantly higher anti-vaccination attitudes, lower vaccine uptake, and lower perceived COVID-19 vaccine knowledge than males. Historical scepticism towards vaccination, mistrust of the medical literature, and the myth of infertility could be possible causes. Positive indicators

of vaccination include older age, smoking, and a higher income. While having a child at home is a negative indicator.

List Of Abbreviations

CI	Confidence Interval
HCWs	Health Care Workers
IRB	Institutional Review Board
OR	Odds Ratios
PHC	Primary Health Care
VAX	Vaccination Attitudes Examination

Declarations

Ethics and Consent: Following an explanation of the study's purpose, risks, and benefits of participation, all subjects were invited to participate voluntarily. A waiver for signed consent was obtained because the study poses low risk to subjects and does not include any procedures that require written consent. The An-Najah National University institutional review board approved the study. It was ensured that the participants' privacy and confidentiality were respected.

Consent for publication: "Not applicable."

Availability of data and materials: The dataset supporting the conclusions of this article is included within the article and its additional file.

Competing Interest: The authors declare that they have no competing interests in this section.

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Author contributions: ZN and BM contributed to idea conception, study design, supervised acquisition and analysis of data, manuscript writing. ZN, BM and QA analyzed the data and interpreted the results. All authors wrote the first draft of the manuscript, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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