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Influenza virus vaccine compliance among pregnant women during the COVID-19 pandemic (pre-vaccine era) in Israel and future intention to uptake BNT162b2 mRNA COVID-19 vaccine

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ABSTRACT

The influenza virus vaccine, used worldwide as an annual preventive measure, is especially recommended for at-risk populations. Older adults and pregnant women are therefore offered the flu shot free of charge in Israel. The Israel Ministry of Health's rationale for giving the influenza vaccine to pregnant women is to avoid serious complications that could harm both mother and foetus. In Israel, the winter of 2020/2021 was marked by a third surge of COVID-19, raising the risk of contracting the SARS-CoV-2 virus and the level of fear among the population. The influenza vaccine protects individuals from the flu and thus helps prevent an additional burden on medical centres treating COVID-19 patients. The aim of the present study was to assess compliance of pregnant and postpartum women to influenza vaccine uptake during winter 20/21 period. A survey questionnaire was distributed to examine factors predicting women's attitudes toward the influenza vaccine. Questionnaire items based on the Heath Belief Model examined participants' perceptions regarding influenza and the vaccine. The questionnaire also evaluated participants' hypothetical willingness to get immunized with the Pfizer COVID-19 vaccine upon its arrival in Israel. The results showed a higher prevalence of influenza vaccine uptake among Jewish women than Arab women, while level of trust in healthcare providers was stronger among Arab participants than among Jewish participants. The findings indicate that the pregnant and postpartum community needs better information dissemination and education regarding the importance of the influenza vaccine. Decisions regarding uptake of the COVID-19 vaccine upon future availability were found to be unrelated to influenza vaccine perceptions. The results call for raising public awareness regarding influenza immunization in addition to offering the vaccine at routine pregnancy follow-up appointments.

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1. Introduction

Influenza is a contagious viral winter disease that passes through the respiratory tract. It can develop into serious illness, leading to hospitalization and in severe cases even death [1]. Because the influenza virus undergoes frequent genetic modifications, the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recommend annual influenza vaccination for population groups considered at high risk for exposure to the virus and or for developing severe illness [1–4].

Pregnant women are at high risk for developing severe influenza complications, including admission to medical centres and death [5]. First trimester miscarriages, preterm births, emergency caesarean births and low birth weight [6]. Hence, vaccination of pregnant women is designed to reduce the morbidity and mortality of both mother and child [7]. Maternal influenza vaccination is effective in preventing influenza in infants up to six months of age who are not yet eligible for influenza vaccination [8,9] and even the risk of preterm birth and low birth weight [10].

Despite recommendations for annual influenza immunization, vaccine compliance rates among pregnant women have remained low in many countries worldwide [11–14].

Abbreviations: CDC, Centers for Disease Control and Prevention; COVID-19, Coronavirus Disease 2019; FCV-19S, Fear of COVID-19 Scale; HBM, Health Belief Model; HCI, Health Care Institutions; HCP, Health Care Providers; M, mean; MOH, Ministry of Health; PSS, Perceived Stress Scale; SD, Standard deviation; WHO, World Health Organization.

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The Health Belief Model (HBM) proposes several factors that influence influenza vaccine compliance [15] in different population groups [16]. The model consists of five components: perception of disease severity; perceived susceptibility; perceived benefits of implementation of health behaviour; perceived barriers to behaviour change; and cues to action.

One study that used this model found that perceptions of vaccine efficacy, vulnerability and disease severity predict compliance with the influenza vaccine among pregnant women [17]. Another study reported that pregnant women who felt susceptible to influenza had a higher chance of being vaccinated than those who did not feel at risk for influenza [18]. Low coverage rates were associated with various barriers, among them misconceptions and concerns about vaccine safety and side effects to the mother and baby [19–21], although no evidence was found [22,23].

Studies indicate a positive relationship between a person's trust in healthcare workers and the decision to be vaccinated [24,25]. Although a recommendation from healthcare workers is the most important factor in vaccine uptake [26,27], only trust in medical organizations was found to predict vaccination. Moreover, trust in the health system is a key variable in managing infectious diseases such as influenza. Studies on influenza H1N1 show that public opinion is divided over vaccines and is linked to mistrust in governments and authorities [28].

In the winter of 2020–2021, coping with influenza became more complex for health systems due to the outbreak of the SARS-CoV-2 epidemic, which posed a danger to public health. At that time, the COVID-19 vaccine was still in the clinical trial stages nevertheless, the influenza vaccine, remained available [29]. Therefore, the CDC recommended influenza vaccination for the entire population [30]. No data were specific to pregnant women according to January 1, 2020 report from the Israel MOH [31].

Pregnant women who are at risk of contracting the flu and suffering from its complications are now also at risk for psychological consequences associated with the COVID-19 pandemic [32–38]. Therefore, the present study sought to examine the factors influencing compliance with the influenza vaccine among pregnant and postpartum women in the shadow of the COVID-19 pandemic. The study also assessed whether emotional aspects such as stress and fear of COVID-19 are related to influenza vaccine compliance in this population. Moreover, the study examined the factors associated with intentions among pregnant and postpartum women to be vaccinated against COVID-19 after the vaccine is approved.

2. Methods

The current study developed an online survey that was distributed between the end of September 2020 and mid-January 2021. During this period in Israel, influenza vaccination was recommended. In addition, these months were marked by the second and third waves of the COVID-19 epidemic. The survey was distributed using the snowball method [39] through social networks such as Facebook and WhatsApp. This method recruited voluntary participants by asking respondents to forward the questionnaire link to women who met the inclusion criterion of being six months prior to or after giving birth.

The questionnaire was available both in Arabic and in Hebrew. The opening of the questionnaire explained the purpose of the study and promised anonymity to the respondents. The study was approved by the Emek Yezreel Academic College Ethics Committee, approval number YVC EMEK 2020–108.

2.1. Research tool

The questionnaire was based on the HBM and included the model's five variables: perceived disease threat (severity and harm), barriers, efficacy, incentives for action and impulses for action. The questions were adapted and modified for the present study [40]. Answers were scored on a 5-point scale ranging from 0 = never to 4 = often for all HBM variables. Internal consistency was calculated with Cronbach α for scales with at least three items, and with Spearman correlation coefficient for scales with two items.

2.1.1. Perceived disease threat

This variable consists of two parts: 1) Perceived susceptibility included two items (e.g., "I am very worried my baby will get the flu", $r = 0.63$ ($p < .001$); 2) Perceived severity included three items (e.g., "If a pregnant woman gets the flu, her chances of developing a serious illness are greater than those of the general public", $\alpha = 0.87$).

2.1.2. Perceived vaccination barriers

Four items were used to examine this variable (e.g., "The influenza vaccine is not safe during pregnancy", $\alpha = 0.87$).

2.1.3. Perceived vaccination benefits

Three items were used to examine this variable (e.g., "The influenza vaccine can protect my baby during the first months of life", $\alpha = 0.90$).

2.1.4. Action incentives (impulse to act)

Cues for action consisted of four items (e.g., "If the doctor recommended the flu vaccine for pregnant women, I would get vaccinated", $\alpha = 0.92$).

Participants were asked to rate all items on a scale ranging from 1 (do not agree at all) to 5 (strongly agree).

2.1.5. Stress assessment

The PSS-10 (Perceived Stress Scale) developed by Cohen et al. was used to assess stress [41]. This questionnaire examines the extent to which an individual assesses situations in her life as charged with stress and pressure. It refers to perceptions and emotions related to recent levels of general stress. The questionnaire included ten items. Overall scores ranged from 0 to 40, with higher scores indicating higher levels of perceived stress. Scores between 0 and 13 were considered a low stress level, scores ranging from 14 to 26 were considered a moderate stress level, and scores ranging from 27 to 40 were considered a high stress level ($\alpha = 0.80$).

2.1.6. COVID-19 fear questionnaire

The Fear of COVID-19 Scale (FCV-19S) is a self-reporting index that aims to assess fear of COVID-19 [42]. This scale consists of seven items relating to emotional fear responses to the pandemic. Participants were asked to respond on a five-point Likert scale ranging from 1 (do not agree at all) to 5 (strongly agree). The overall score ranges from 7 to 35, with a higher score indicating a greater FCV-19S. The questionnaire examines two factors: 1) Emotional response to fear included four items (e.g., "Thinking about corona disease makes me uncomfortable"; "When I watch the news and stories about coronavirus on social media, I am stressed and/or anxious", $\alpha = 0.85$); 2) Physical symptoms of fear included three items (e.g., "My hands become damp when I think of the coronavirus"; "My pulse is accelerated when I think I have corona", $\alpha = 0.86$.) The correlation between the two scores was high ($r = 0.65$, $p < .001$) and thus their total score was used ($\alpha = 0.89$).

2.1.7. Trust

Trust in the healthcare system was measured based on two subscales from a questionnaire developed by Egede [43]. We used ten items that test trust in healthcare providers (HCP) (e.g., "I can trust my doctor's decisions about which medical treatments are best for

me", α = 0.92). Three more items were used to test trust in healthcare institutions (HCI) (e.g., "Health institutions provide the highest quality in the field of medical care", α = 0.58).

In addition, five questions were added that examined trust in how the MOH in Israel managed the COVID-19 crisis (e.g., "The Ministry of Health does not care enough about the population in Israel"). Participants were asked to rate each item on a scale ranging from 1 (do not agree at all) to 5 (strongly agree) (α = 0.69).

2.1.8. Background characteristics

Questions included religion, age, marital status, children, health, residential setting (urban/rural), level of education, employment status, economic status, religiosity.

2.1.9. Subjective health assessment

Ranging from 1- not good up to 5-excellent.

Influenza vaccination- yes (1) no (0).

2.1.10. Questions about COVID-19 disease

Has the participant/her family contracted the COVID-19 virus yes (1) no (0)?

During the time the data were collected (September 2020 to January 2021) all the women who participated in this study were younger than 45 years old and therefore did not meet the age criterion for the COVID-19 vaccination, which was available for individuals over the age of 60. Thus, they were asked the following hypothetical question: "If possible, would you get the COVID-19 vaccination after giving birth?" Willingness to receive COVID-19 vaccination - yes (1) no (0).

2.2. Data analysis

The data were analysed with SPSS version 27. Internal consistencies were calculated for the study variables with Cronbach α, and the variables were composed of the item means. Demographic and background variables were represented by means and standard deviations or by frequencies and percentages. Means, standard deviations, and Pearson correlations were calculated for the study variables. Comparisons of the study variables by ethnicity were calculated with *Z* tests for the significance of the difference between independent proportions, Chi-square tests, and *t*-tests. Multiple hierarchical logistic regressions were calculated to assess the extent to which the background variables and the study variables were related to the odds for vaccination. The background variables were entered in step 1 and the study variables in step 2.

3. Results

3.1. Demographics

The study sample included 410 Israeli women who were either pregnant (n = 293, 71.5%) or had given birth during the past six months (n = 117, 28.5%). Participants were Moslem (n = 243, 59.3%), Jewish (n = 99, 24.1%), and Christian (n = 68, 16.6%). They ranged in age from 25 to 34 years old (63.2%) and most were married (n = 403, 98.3%). Most of the women already had children (n = 305, 74.4%) up to 8 children (M = 1.87, SD = 1.01). They generally reported good health (n = 373, 91.0%).

About half of the women lived in urban localities (n = 220, 53.7%) and the others lived in rural areas (n = 190, 46.3%). About three-fourths had an academic education (n = 314, 76.6%) and most were employed (n = 293, 71.5%). Close to half reported that their economic status was below average (n = 190, 46.3%), while the others reported average (n = 119, 29.0%) or above average economic status (n = 101, 24.6%). About a third of the women were secular (n = 121, 29.5%), another third were somewhat religious (n = 151, 36.8%), and rest were religious (n = 138, 33.7%).

The pregnant women were at 24.37 weeks average (SD = 8.90), while the infants of those who had already given birth were 3.42 months old on average (SD = 1.74). Most of the pregnancies were spontaneous (n = 266, 90.8% of 293) and were not at risk (n = 239, 81.6% of 293). Postpartum women with infants had pregnancies that lasted 27 to 42 weeks (M = 39.12 weeks, SD = 1.68). Most had regular deliveries (n = 84, 74.4% of 117), and all infants were in good health. Most of the women were breastfeeding (n = 84, 74.4% of 117), and most of the others had done so and stopped (n = 18, 15.4% of 117).

3.2. Influenza vaccination

A little over half the participants in the sample reported getting the influenza vaccination (n = 223, 54.4%). Most of these reported always or usually getting the influenza vaccination in the past (n = 145, 65.1%) or at least sometimes (n = 35, 15.7%). Women who had not been vaccinated reported they had never (n = 121, 64.7%) or rarely (n = 23, 12.3%) been vaccinated for the flu ($\chi^2(4) = 164.32$, $p < .001$).

Similarly, most of the women who already had children and had gotten the influenza vaccination that year reported doing so in all their previous pregnancies (n = 118, 77.6% of n = 152), while those who had chosen not to be vaccinated during this pregnancy were also not vaccinated in the past (n = 91, 79.8% of n = 114) ($\chi^2(2) = 138.85$, $p < .001$). In addition, the same pattern emerged regarding plans for future pregnancies (getting vaccinated: n = 171, 97.2% of n = 176; not getting vaccinated: n = 106, 71.6% of n = 148) ($\chi^2(1) = 168.87$, $p < .001$).

The women who chose not to be vaccinated (n = 187) gave various reasons (each could note several): "The vaccination is ineffective" (n = 68, 36.4%); "The vaccination may harm the foetus" (n = 41, 21.9%); "The vaccination is not safe" (n = 36, 19.3%); "I was unaware that the vaccination was recommended for pregnant women" (n = 26, 13.9%); "Influenza is not dangerous" (n = 23, 12.3%); other reasons (n = 41, 21.9%), where other reasons related to COVID-19.

Means for the study variables were rather moderate (Table 1). Perceived susceptibility, severity, vaccine benefits, action cues, trust in healthcare institutions, and PSS exhibited rather moderate means. Perceived barriers for vaccination and fear of COVID-19 had moderate-low means, while the mean for trust in healthcare providers was rather high. It is interesting to note that about half the women reported that a family member contracted the COVID-19 virus (n = 203, 49.5%), and 26 women (6.3%) contracted the virus themselves. In most cases (24 of 26) when the woman was sick, a family member was sick as well. For this reason and due to the small percentage of women who were sick with COVID-19, a combined variable was computed that reflected sickness in a family member and/or the woman herself.

Significant correlations were found between the study variables. Getting the influenza vaccination was related to higher perceived susceptibility, higher perceived severity, lower barriers, higher perceived benefits, more cues for action, and higher trust in healthcare providers. Perceived susceptibility and severity were positively related, and both were positively related to perceived benefits, action cues, and a higher FCV-19S score. Perceived benefits and action cues were positively related as well, and both were positively related to trust in healthcare providers and institutions. Perceived benefits and action cues were negatively related to perceived vaccination barriers. Contracting the COVID-19 virus and experiencing greater fear of it were related to higher perceived barriers to influenza vaccination, while a higher FCV-19S score was related to greater stress (PSS).

Table 1
Influenza virus vaccine responsiveness study variables as means, standard deviations and correlations (N = 410).

	M (SD)	2.[#]	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Influenza Vaccination (0–1)	0.54 (0.50)	0.24*	0.29*	-0.55*	0.55*	0.62*	0.16*	0.11	-0.14	-0.02	-0.01
2. Susceptibility (1–5)	3.18 (1.22)		0.56*	-0.03	0.34*	0.45*	0.18*	0.10	-0.01	0.33*	0.17
3. Severity (1–5)	3.14 (1.16)			-0.02	0.41*	0.40*	0.11	0.07	-0.02	0.22*	0.09
4. Barriers (1–5)	2.25 (1.07)				-0.41*	-0.50*	-0.14	-0.11	0.19*	0.24*	0.03
5. Benefits (1–5)	3.27 (1.21)					0.66*	0.21*	0.18*	-0.11	-0.03	-0.11
6. Cues for action (1–5)	3.37 (1.33)						0.30*	0.24*	-0.11	0.07	0.03
7. Trust in HCP (1–5)	4.00 (0.77)							0.56*	-0.01	0.06	-0.04
8. Trust in HCI (1–5)	3.36 (0.78)								0.02	-0.04	-0.23
9. Self/family contracted COVID-19 (0–1)	0.50 (0.50)									-0.06	-0.10
10. FCV-19S (1–5)	2.45 (0.94)										0.34*
11. Stress-PSS (0–4)	1.92 (0.72)										

Abbreviations: M, mean; SD, Standard deviation, HCP, Health Care Providers; HCI, Health Care Institutions COVID-19, Coronavirus disease of 2019; FCV-19S, Fear of COVID-19 Scale; PSS, Perceived Stress Scale.
*$p < .001$, Bonferroni correction for multiple comparisons was applied.
[#] The column headers correspond to the horizontal variables numbered 1–11.

More Jewish women (n = 76, 76.8%) than Arab women (n = 147, 47.3%) were vaccinated against influenza (Z = 5.13, $p < .001$). In addition, most HBM variables were higher among Jewish women (Severity: M = 3.52 SD = 1.13, Barriers: M = 1.72 SD = 0.95, Benefits: M = 4.02 SD = 0.99, Action cues: M = 3.83 SD = 1.11) than among Arab women (Severity: M = 3.02 SD = 1.15, Barriers: M = 2.42 SD = 1.05, Benefits: M = 3.04 SD = 1.18, Action cues: M = 3.23 SD = 1.37) (Severity: $t(408) = 3.80$, $p < .001$; Barriers: $t(180.14) = -6.19$, $p < .001$; Benefits: $t(194.49) = 8.26$, $p < .001$; Action cues: $t(200.45) = 4.47$, $p < .001$). Arab women reported lower levels of perceived severity, benefits, and action cues and higher levels of perceived barriers than Jewish women. No ethnic difference was found for perceived susceptibility (p = .298). Trust in HCP and HCI was higher among Arab women (HCP: M = 4.07 SD = 0.76, HCI: M = 3.43 SD = 0.79) than among Jewish women (HCP: M = 3.79 SD = 0.77, HCI: M = 3.13 SD = 0.71) (HCP: $t(408) = 3.24$, p = .001; HCI: $t(408) = 3.36$, $p < .001$).

Moreover, more women with an academic education (n = 182, 58.0%) were vaccinated against the flu than women whose education was not academic (n = 41, 42.7%) (Z = 2.63, p = .009). There were no significant differences between receiving the influenza vaccination and maternal status (pregnant/infant up to six months old), residential area (urban/rural), employment status, economic status, religiosity or having children (p = .079 to p = .508).

Thus, a multivariate logistic regression was used to examine the hypothesis regarding influenza vaccination compliance. Ethnicity (1-Jewish, 0-Arab) and level of education (1–academic, 0-non-academic) were entered in the first step, and the HBM variables, trust in healthcare providers and healthcare institutions, and the COVID-19-related variables were entered in the second step (Table 2).

The regression model was found to be significant ($\chi^2(12) = 266.70$, $p < .001$), explaining about 64% of the variance in influenza vaccination compliance (Nagelkerke'sR^2 = 0.639). Ethnicity was significant in the first step but lost its significance in the second step. The HBM variables were found to increase the odds for vaccination significantly, such that lower perceived barriers, higher perceived benefits, and more cues for action were related to higher odds for influenza vaccination compliance. It is interesting to note that the demographic variables, trust in HCP and HCI, and the COVID-19-related variables did not make a significant contribution.

3.3. COVID-19 vaccination

At the time of data collection, the women in this study did not meet the age criterion for COVID-19 vaccination. Thus, a hypothetical question was asked regarding their willingness to receive the COVID-19 vaccination when it becomes available for them after giving birth. For this reason, the HBM variables were not examined regarding the COVID-19 vaccination. The relevant variables associated with the responses to this question were the background variables, trust in HCP, trust in HCI, trust in the Israel MOH regarding the COVID-19 pandemic, self/family contracted COVID-19, FCV-19S, and stress (PSS).

About 40% of the women (n = 161, 39.3%) reported that they would be willing to receive the COVID-19 vaccination. Significant relationships were found with the background variables. About two-thirds of the Jewish women (n = 62, 62.6%) agreed to receive the vaccination, compared with about one-third of the Arab women (n = 99, 31.8%) (Z = 5.46, $p < .001$). Close to half of the women with an academic education (n = 141, 44.9%) were willing to receive the vaccination, compared with about one-fifth of the women without an academic education (n = 96, 20.8%) ($Z = 4.23p < .001$). Similarly, close to half of the employed women (n = 132, 45.1%) were willing to be vaccinated, compared with about a quarter of the unemployed women (n = 29, 24.8%) ($Z = 3.79p < .001$). Higher economic status was related to higher odds for COVID-19 vaccine willingness (OR = 1.33, p = .001, 95 % CI = 1.12, 1.58) as well. Further, about half of the urban women (n = 103, 46.8%) were willing to receive the vaccination, compared with close to one-third of the rural women (n = 58, 30.5%) ($Z = 3.37p < .001$). Finally, close to half of the non-religious women (n = 124, 45.6%) were willing to receive the vaccination, compared with about a quarter of the religious women (n = 37, 26.8%) ($Z = 3.68p < .001$).

Contracting the COVID-19 virus was associated with lower willingness to receive the vaccination: Among those who had not contracted the virus themselves and neither had their family members, close to half (n = 93, 45.41%) were willing to be vaccinated, compared to about a third of those who themselves or their family members had contracted the virus (n = 68, 33.2%) ($Z = 2.53p$ = .011).

Trust in the Israel MOH regarding the COVID-19 pandemic was related to greater likeliness to be willing to be vaccinated against

Table 2
Logistic regression model for receiving the influenza vaccination, including background variables, HBM variables, trust in healthcare providers and institutions, and COVID-19 related variables (N = 410).

	B	*SeB*	*OR* (95 %*CI*)	*p*
Step 1				
Ethnicity (Jewish)	1.23	0.27	3.41 (2.01, 5.77)	<0.001
Education level (academic)	0.38	0.24	1.46 (0.91, 2.36)	0.119
Step 2				
Ethnicity (Jewish)	−0.26	0.44	0.77 (0.32, 1.83)	0.551
Education level (academic)	0.38	0.35	1.46 (0.73, 2.93)	0.282
Susceptibility	0.05	0.17	1.05 (0.76, 1.45)	0.782
Severity	0.28	0.17	1.32 (0.94, 1.84)	0.104
Barriers	−1.34	0.21	0.26 (0.17, 0.40)	<0.001
Benefits	0.60	0.17	1.83 (1.31, 2.56)	<0.001
Cues for action	0.80	0.17	2.24 (1.6, 3.13)	<0.001
Trust in HCP	−0.07	0.25	0.93 (0.57, 1.51)	0.772
Trust in HCI	−0.19	0.26	0.82 (0.49, 1.38)	0.459
Self/family contracted COVID-19	−0.08	0.31	0.92 (0.5, 1.67)	0.782
FCV-19S	0.31	0.19	1.36 (0.95, 1.96)	0.096
Stress (PSS)	−0.25	0.24	0.78 (0.49, 1.25)	0.299

Note. Step 1: $\chi^2(2) = 30.12$, $p < .001$, Nagelkerke's$R^2 = 0.095$. Step 2: $\chi^2(10) = 236.58$, $p < .001$, Nagelkerke's$R^2 = 0.544$.
Abbreviations: OR, Odd Ratio, CI, Confidence Interval; HCP, Health Care Providers, HCI, Health Care Institutions; FCV-19S, Fear of COVID-19S; PSS, Perceived Stress scale.

COVID-19 (*OR* = 1.35, $p = .023$, 95 %*CI* = 1.04, 1.75). However, trust in HCP, trust in HCI, FCV-19S, and stress (PSS) were unrelated to willingness to receive the COVID-19 vaccination ($p = .082$ to $p = .915$).

The hypothesis was examined using a multivariate logistic regression regarding willingness to receive the COVID-19 vaccination. Ethnicity (1-Jewish, 0-Arab), level of education (1-academic, 0-non-acadmic), employment status (1-employed, 0-unemployed), economic status (1–5), residence (1-urban, 0-rural), and religiosity (1-not religious, 0-religious) were entered in the first step. Trust in HCP/HCI, trust in the Israel MOH regarding the COVID-19 pandemic, and the COVID-19-related variables were entered in the second step (Table 3).

The regression model was found significant ($\chi^2(12) = 79.03$, $p < .001$), explaining about 24% of the variance in willingness to receive the COVID-19 vaccination (Nagelkerke's$R^2 = 0.239$). Several background variables were found to significantly increase the odds of being willing to be vaccinated against COVID-19, among them being Jewish, having an academic education, being employed, and living in an urban region. Further, a higher level of trust in the Israel MOH regarding the COVID-19 pandemic was related to greater likelihood to be willing to receive the vaccination. Other COVID-19-related variables did not make a significant contribution.

4. Discussion

This is the first study to explore the prevalence of seasonal influenza vaccine compliance among pregnant women in Israel during the COVID-19 pandemic. During the winter season 2020–2021 when the survey was conducted, the COVID-19 outbreak reached record heights during a second and third wave. At the beginning of this period, the MOH feared a double outbreak of influenza in addition to COVID-19, which the already overloaded health system would be unable to handle. Because no one knew when the COVID-19 vaccine would be approved and made available in Israel, the MOH urged the entire population, and especially at-risk groups such as senior citizens and pregnant women, to get the influenza vaccine, which was being given free of charge. Never-

Table 3
Logistic regression model for willingness to receive the COVID-19 vaccination, with background variables, trust in HCP/HCI/MOH, and COVID-19 related variables (N = 410).

	B	*SeB*	*OR* (95 %*CI*)	*p*
Step 1				
Ethnicity (Jewish)	0.94	0.27	2.56 (1.50, 4.39)	<0.001
Education level (academic)	0.77	0.31	2.15 (1.17, 3.96)	0.014
Employment status (employed)	0.66	0.27	1.93 (1.14, 3.26)	0.014
Economic status	−0.04	0.11	0.96 (0.79, 1.19)	0.733
Residence (urban)	0.62	0.22	1.86 (1.20, 2.87)	0.005
Religiosity (not religious)	0.35	0.26	1.43 (0.86, 2.35)	0.165
Step 2				
Ethnicity (Jewish)	1.18	0.30	3.25 (1.79, 5.9)	<0.001
Education level (academic)	0.90	0.32	2.45 (1.30, 4.62)	0.005
Employment status (employed)	0.64	0.27	1.91 (1.11, 3.26)	0.019
Economic status	−0.06	0.11	0.94 (0.76, 1.17)	0.603
Residence (urban)	0.61	0.23	1.84 (1.17, 2.90)	0.008
Religiosity (not religious)	0.38	0.27	1.46 (0.87, 2.46)	0.153
Trust in HCP	0.12	0.18	1.13 (0.80, 1.60)	0.490
Trust in HCI	0.24	0.19	1.27 (0.88, 1.84)	0.197
Trust in MOH	0.36	0.16	1.43 (1.04, 1.98)	0.028
Self/family contracted COVID-19	−0.28	0.23	0.76 (0.48, 1.19)	0.228
FCV-19S	0.19	0.14	1.21 (0.93, 1.58)	0.158
Stress (PSS)	−0.20	0.18	0.82 (0.57, 1.17)	0.277

Note. Step 1: $\chi^2(6) = 58.28$, $p < .001$, Nagelkerke's$R^2 = 0.180$. Step 2: $\chi^2(6) = 20.75$, $p = .002$, Nagelkerke's$R^2 = 0.059$).
Abbreviations: HCP, Health Care Providers, HCI, Health Care Institutions; MOH, Ministry of Health; COVID-19, Coronavirus disease-19; FCV-19S, Fear of COVID-19 Scale.

theless, MOH data shows only a slight increase in uptake of the influenza vaccine among the general public compared to the previous year.

The present research aimed to assess hypotheses regarding the factors affecting pregnant women's decision to get the influenza vaccination. Analysis of the HBM questionnaire showed that the pregnant and postpartum women who participated in the survey did not change their approach toward influenza vaccination despite the second and third waves of COVID-19. This was true both for those who avoided vaccination and for those who were routinely vaccinated every year. A similar trend was reported by Blanchard et al. [44]. One possible explanation for not being vaccinated may be attributed to the fact that perceptions of seasonal influenza were dwarfed by the infectious COVID-19 disease. Another possibility is that the public perceived that wearing a face mask as dictated by law provided protection from contagious diseases. Moreover, the lockdowns and stay at home orders gave people the impression of safety. This misconception may have caused people to discount the need for real biological defence by means of the influenza vaccine.

In the present study, 45.6% of the women (187 out of 410 survey participants) chose not to get a flu shot. This is disturbing due to the fact that among women who contract the influenza virus, pregnant women have more complications than non-pregnant women in the same age group.

Moreover, many respondents were unaware of whether the influenza vaccine is safe for the foetus. This lack of knowledge may hinder making an informed decision by weighing benefits vs. risks, as supported by worldwide research from previous years [11,13].

4.1. Influenza vaccination

The present study's findings show that while pregnant women generally trust the HCP, its recommendations for flu vaccine were ignored [11,44]. Indeed, during pregnancy follow-up visits, the need for influenza vaccination should be more strongly emphasized. The data correlations demonstrate that women who perceive the actual situation, including susceptibility, severity, benefits and trust in the health system, are more likely to get the influenza immunization [45]. In contrast, those who contracted COVID-19 did not get the influenza vaccination and had greater perceived barriers. In addition, FCV-19S was related to higher stress among these women.

Among the survey participants, Jewish women exhibited a higher rate of influenza vaccination than Arab women, while Arab women expressed higher trust in HCP. This finding offers hope of achieving maximal coverage in influenza vaccination among pregnant women program by a MOH policy to prevent illness through promoting, encouraging and implementing an effective strategy, as reported in Argentina [46].

4.2. COVID-19 vaccination

The study hypothesis regarding future immunization against COVID-19 took into consideration variables of ethnicity, academic education, employment status, economic status, residential area, religious belief and trust in the healthcare team. Forty percent of the participants expressed their hypothetical willingness to get vaccinated against COVID-19 after giving birth, which is quite a good rate. Positive correlations were found between willingness to receive the COVID-19 vaccine and academic education, being employed, and living in an urban area. These results are in line with a recent publication by Caspi et al, [47], according to which initial acceptance of the COVID-19 vaccine in Israel was low among rural residents and those with low socioeconomic status. Nevertheless, together with an intensive COVID-19 immunization campaign open to all population groups, public willingness has increased substantially, reaching over 70% of all eligible residents, including the 20–40 age group that is pertinent to pregnant women. At the time of data collection for this study, the MOH had not yet recommended the COVID-19 vaccine for pregnant women. Trust in the MOH correlated with higher intention to uptake the COVID-19 vaccine, while trust in HCP was unrelated. These results are contrary to the case of the influenza vaccine, where trust in HCP was a determining factor in women's influenza vaccine compliance.

The strengths of this study are apparent in the novelty of exploring pregnant women's influenza vaccine compliance during the COVID-19 pandemic while considering emotional aspects such as stress and fear of contracting the virus. An advantage of the survey is its inclusion of numerous questions related to multiple immunization perceptions. In addition, the women's backgrounds and demographics, including urban and rural residents, Muslim, Christian and Jewish women, and varying academic and socioeconomic status, also lend validity to the study in representing the prevalence of influenza vaccination in Israel. Moreover, the study period covered more than four months, thereby providing many women the opportunity to answer.

A limitation of the study is the non-random sampling, as the questionnaire was disseminated via Facebook, WhatsApp, and snowball sampling. This might have produced a biased, non-representative sample. Israeli population is composed of about 75% Jewish residents, and about 20% Arab residents, whereas in the current sample the distribution is about 24% and 76% respectively. Further, about 30% of the Israeli population has an academic education, compared with about 76% in our sample [48]. Thus, the results may be biased in favour of the Arab and more highly educated populations. Both variables were controlled for in the statistical analyses, yet they might have introduced other, unknown, biases. Future studies are advised to use random sampling.

4.3. Future implications

Increasing vaccination uptake among pregnant women is of utmost important and can be accomplished by changing perceptions and beliefs. Further studies are warranted by public health authorities to better understand why pregnant and postpartum women, who though they are young are also more vulnerable, are opting to decline influenza immunization. Moreover, guidelines and education are needed to promote influenza vaccination as part of standard of care for pregnant women. To this end, recommendations for influenza vaccine should be included as early as possible in routine pregnancy examinations [15]. Among postpartum women, the influenza vaccine can be administered at the six-week follow-up at the obstetrician office or at babies' appointments at the family healthcare clinic. In addition, health care workers attitudes toward vaccinating pregnant women should be explored as they are in direct contact with the pregnant women and should play a key role in advising the women to get vaccinated.

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CRediT authorship contribution statement

Ola Ali Saleh: Conceptualization, Formal analysis, Writing – original draft. **Ofra Halperin:** Writing – review & editing.

Declaration of Competing Interest

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

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