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Israeli parents' views on coronavirus (COVID-19) vaccinations for children: A cross-sectional study

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ABSTRACT

Background: Parents play the decisive role in children's vaccination. Our study aimed at assessing attitudes of parents toward the COVID-19 vaccine for children aged 5–18 and to define sources of influence on these attitudes, the barriers and reasons for hesitation.

Methods: In this cross-sectional study, 138 Israeli parents of 5–18 aged children completed a self-administered structured questionnaire.

Findings: More than a quarter of parents reported that they did not intend to vaccinate their children. Independent of other demographic characteristics, parents who do not vaccinate their children accordingly to the routine vaccinations have five-fold significant odds not to vaccinate with COVID-19 vaccine (OR = 4.8, 95% CI: 1.8–12.7). Greater social influence was significantly and negatively associated with intentions not to vaccinate a child. Among parents who do not intend to vaccinate their children, the most frequent reasons were fear of possible side effects (92%), vaccine novelty (92%) and lack of belief in its effectiveness (69%).

Discussion: This study found that vaccination in the past as part of routine government immunization programs predict a tendency to vaccinate children during the pandemic. Among the factors associated with the intention not to vaccinate, concerns and uncertainty about the necessity of the vaccine, its side effects and reliability have been emphasized.

Application to practice: Cultural-religious adjustments should be applied when implementing interventions aiming to promote vaccination in routines and emergencies. Social influence is important in adopting a positive attitude toward vaccines. Public health professionals should incorporate those parents who have vaccinated their children and have a positive attitude toward vaccination.

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Introduction

Since its emergence in Wuhan, China in December 2019, the coronavirus disease (COVID-19) has spread worldwide and became a pandemic of international concern. In Israel, there have been >4.5 million people infected and 11,643 deaths occurred due to COVID-19 (Ministry of Health, 2022a). Vaccines are critical tools for helping to bring the pandemic under control, combined with effective testing, treatment, and existing prevention measures. In order to proactively manage the COVID-19 pandemic, 15 vaccines have already been licensed or approved for emergency use and at least 140 candidate vaccines are in clinical development (World Health Organization, n.d.).

The COVID-19 vaccination campaign in Israel began on December 20th, 2020. The Ministry of Health has prioritized the provision of the

COVID-19 vaccine, starting with people aged 60 and over, nursing home residents, people at high risk due to serious medical conditions, and front-line health care workers. Later it was extended to all individuals over 18 years (Ministry of Health, 2020). In June 2021 vaccination of children aged 12–18 was approved and in November 2021 vaccination of children aged 5–11 started in Israel (Ministry of Health, 2022b). The COVID-19 vaccine is administered free of charge to every citizen, regardless of age. Since 1995, Israel has had universal national health insurance coverage; all permanent residents are insured in one of four large, competing, nonprofit, health plans (Rosen et al., 2015). These health plans have experience in mobilizing staff for vaccinations as well as the rapid and efficient scheduling and processing of members for vaccinations at a wide range of vaccination sites (Rosen, Waitzberg, & Israeli, 2021). Thus, technical barriers for vaccination which are related to accessibility, availability and price of vaccination are not typical for Israel.

In Israel, the universal immunization program for the routine administration of childhood vaccines are provided in the public infant

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welfare centers in Israel, a community-based system of maternal and child health clinics (called *Tipat Halav*). Most of the children in Israel are vaccinated up-to-date for HBV3, DTaP-IPV-Hib4, PCV3, MMR/MMRV1, HAV1 and HAV2 vaccine (96%, 95%, 91%, 96%, 94% and 86%, respectively) (Stein-Zamir & Israeli, 2017). Booster doses are provided via the school health services. Additionally, in the eighth grade the vaccine against Human Papilloma Virus is provided for both girls and boys. All routine vaccines given at *Tipat Halav* centers and at schools are free of charge (Ministry of Health, 2022c). Currently, a routine vaccination of children is not mandatory and does not constitute a condition for registration for kindergarten or school. Likewise COVID-19 vaccine is offered and administered today to children (subject to parents' decision) free of charge through the health plans around the country (Ministry of Health, 2022b).

High rates of vaccination are required to establish herd immunity and halt the current COVID-19 pandemic progression (Randolph & Barreiro, 2020). In relation to children's vaccination, parents are proxy decision makers for their children, who are unable to decide for themselves (Damnjanović et al., 2018). Despite a massive worldwide COVID-19 vaccination campaign and the high efficacy and safety profile of the vaccines, vaccine hesitancy is still a major barrier to achieving herd immunity across different populations, especially children. In the early days of the pandemic, parents took some comfort in the fact that COVID-19 was much less likely to cause serious illness in children than in adults (Castagnoli et al., 2020). Recent data show that over 10.6 million children in the United States have tested positive for COVID-19 since the onset of the pandemic, representing 18.4% of total cumulated cases (American Academy of Pediatrics, 2021). During the Omicron variant surge, these numbers spiked dramatically with children being 26% of the reported weekly COVID-19 cases (American Academy of Pediatrics, 2021). Furthermore, children can experience severe disease outcomes because of COVID-19 illness, including intensive care unit admission, invasive mechanical ventilation, and death (Woodruff et al., 2022). Long-term complications of the COVID-19 infection include myocarditis, multisystem inflammatory syndrome in children (MIS-C), long COVID and the indirect effects of social isolation and interruption in education (Stein et al., 2022). Evidence has been accumulated about an increase in the diagnosis of MIS-C syndrome, linked to the Omicron wave (CDC, 2022).

Importantly, children and adolescents play a significant role in coronavirus transmission (Stein et al., 2022). A Centers for Disease Control and Prevention (CDC) analysis demonstrated that Pfizer vaccine given to children aged 5–11 years would prevent serious COVID-19 illness, including hospitalizations, intensive care unit admissions and MIS-C morbidity (CDC, 2021). In addition to the efficacy of the mRNA COVID-19 vaccine in preventing symptomatic disease, it is effective in preventing asymptomatic infection and in reducing infectibility, even of the Delta variant (Stein et al., 2022). Moreover, large-scale studies reported an excellent safety profile for children aged 5 to 11 years and for children aged 12 years and older (Hause et al., 2021; Stein et al., 2022). According to the most updated meta-analysis, based on 44 studies including 317,055 parents, lower overall intention of parents to vaccinate their children against the COVID-19 is related to the perception of a very low risk of severe COVID-19 in children and the fact that children are often asymptomatic carriers (Galanis et al., 2022).

Despite the health and economic benefits of the COVID-19 vaccination for children, parents are hesitant about vaccinating their children. Studies report several causes for vaccine hesitancy or refusal. Individual characteristics such as education, age, sex, ethnicity, and parents' occupation related to healthcare are reported (Goldman et al., 2020; Pan et al., 2021). Some parents object on religious or personal grounds; others have socioeconomic barriers, such as low income or multiple children (Gust et al., 2004; Pan et al., 2021). Another important factor is willingness to vaccinate family members against other diseases (Pan et al., 2021). Two beliefs that predict decisions not to vaccinate in general are that vaccines are unsafe and can have long-term negative health effects (Flynn & Ogden, 2004; Gust et al., 2004).

Kumar et al. utilized a social ecological framework to examine influenza vaccine uptake during the 2009 H1N1 pandemic (Kumar et al., 2012). The Social Ecological Model for health promotion explains health outcomes by both individual and social environmental factors (Kumar et al., 2012; Mcleroy et al., 1988). According to this model the behavior is determined by five factors: intrapersonal, interpersonal, institutional, community and public policy factors (Kumar et al., 2012; Mcleroy et al., 1988). The intrapersonal level measures knowledge, attitudes and beliefs, including history of past vaccinations, perceived risk from the disease, trust in the government's handling of the pandemic and perceived presence in the priority group. The interpersonal factors assess the influence of social networks and number of family members and friends who took the vaccine; the community level factors include beliefs about the presence of the disease and the perceived risk to the community. Institutional factors address the presence of regular health providers and the amount of information given by the authorities while policy level includes having health insurance and being in the priority group for immunization (Kumar et al., 2012).

Vaccination refusal and the belief that vaccines may be harmful are more severe when addressing the COVID-19 vaccine. Many parents express concerns regarding the safety of a rapidly-developed vaccine (Goldman et al., 2020; Skjefte et al., 2021; Walker et al., 2021) with internet and social media playing an important role in parents' doubts about vaccine safety and declining vaccination rates (Downs et al., 2008; Puri et al., 2020; Wilson & Wiysonge, 2020). These platforms have a potential for spreading harmful disinformation across networks which may be propagated via the contemporary anti-vaccination movements (Hussain et al., 2018; Puri et al., 2020).

Whether children are vaccinated mainly depends on their parents; therefore, it is important to understand parents' decisions concerning vaccination for their children against COVID-19. Understanding the reasons for the parents' refusal may help to prepare and implement public health interventions to increase rates of children's vaccination. Therefore, the aim of the study was to examine the views of parents of children aged 5–18 regarding their vaccination beliefs and to identify factors associated with the parents' intention to vaccinate their children against Covid-19.

Methods

Participants and study design

Israeli Jewish parents ($n = 138$) of children aged 5–18 were invited to participate in this cross-sectional study. Parents who did not speak Hebrew or parents of children with chronic diseases (clear clinical indications for Covid-19 vaccination) were not included in the sample.

Sample size

The sample size calculation was based on a study from Saudi Arabia (Temsah et al., 2021). In this study, among parents who were hesitant toward routine vaccination, the proportion of willing to vaccinate the child against COVID-19 was 25%; among parents who were not hesitant toward routine vaccination, the proportion of willing to vaccinate the child against COVID-19 was 66%. Thus the total sample size calculation is 20 participants in every group (40 participants in total). On the other hand, the proportion of parents whose children are not vaccinated up-to-date in Israel is ~6–10% (Stein-Zamir & Israeli, 2017). We decided that collecting data on a three-fold larger number of participants as a variable of hesitancy toward routine vaccination was important to account of in relation to willingness to vaccinate against Covid-19 (Goldman et al., 2020). Thus total sample size calculation in this study as we decided should be 120 participants in total. We assumed that as some missing data is expected, we would collect data on 130–140 parents.

Tools

Demographic characteristics

Age of parent (used as a continuous variable); Gender of parent (female; male); Family status (married/in relationship; single/divorced); Number of children aged 5–18 in the family (used as a continuous variable); Education (school only; Bachelor's degree; Master's degree and above); Level of religiosity (secular [nonobservant]) or traditional [observes some religious commandments]; religious [observes all religious commandments]; Profession (being in the field of health care [physician, dentist, pharmacist, physical therapist, nurse, dietician, psychologist etc.]; Socio-Economic Status (SES), based on reported income (Low [less than an average wages in the economy]; Medium [about average]; High [higher than average]).

History of previous child vaccination

Parents were asked whether they vaccinated their child/children according to the routine immunizations program of the Ministry of Health (no or not all vaccinations; yes).

Intention to vaccinate child with COVID-19 vaccine

Parents were asked to report their child/children's vaccination status (already vaccinated against COVID-19; is about to get the vaccine soon; will not because recently got sick and "was not vaccinated and will not be vaccinated". Based on this question, the dichotomic variable "Intention" was created (yes - for those whose child/children had already been vaccinated or would be vaccinated soon vs. no - for those child/children had not been vaccinated and would not be vaccinated).

Attitudes toward COVID-19 vaccine for children were measured using a 19-items tool addressing different aspects of vaccination and created by Levi (Levi, 2014). Items were rated on a 4-point Likert-type scale (1 = do not agree at all; 4 = strongly agree). The scoring for items number 3, 4 and 9 (Table 4) was reversed. Mean attitude score was calculated, while the higher score represented more positive views. The reliability of this tool in the previous study (Levi, 2014) was high (Cronbach's Alpha method = 0.88) and in this study Cronbach's Alpha is 0.89. These tools assessed the intrapersonal and community levels.

Social influence

Six items assessed the influence of family, friends, coworkers, media, social networks, and religious leaders on attitudes toward the COVID-19 vaccine (Levi, 2014) representing the intrapersonal level. Items were rated on a 4-point Likert-type scale (1 = do not agree at all; 4 = strongly agree). Mean social influence score was constructed, while the higher score represented higher social influence on attitudes toward COVID-19 vaccination of children. The reliability of this tool in this study was high (Cronbach's Alpha = 0.83).

The reasons for indecision and rejection of COVID-19 vaccine

Eleven items addressing possible reasons for indecision and rejection of COVID-19 vaccine were based on a study carried out by Akarsu et al. (Akarsu et al., 2021). Items were rated on a 4-point Likert-type scale (1 = do not agree at all; 4 = strongly agree) but following a modest sample size were categorized to agree/disagree. The aim of this tool was to obtain information on specific causes for indecision/rejection and was not used to calculate a score. This tool included questions assessing both intrapersonal and community levels.

No questions addressed the policy and institutional levels (having health insurance and a regular healthcare provider and being in the priority group for vaccination) as all children in Israel are insured and are perceived as being in a priority group.

Procedure

The pilot included four parents: two Israeli-born parents (one male and one female) and two parents (one male and one female)

immigrants from Former Soviet Union. These parents answered the questionnaire and supplied their feedback on clarity of the questions. No suggestions for repair were reported.

The data was collected using the snowball method from December 2021 till January 2022. Parents were recruited to participate through social media and asked to forward the link to other parents. The response to the questionnaire was completely anonymous and voluntary, no compensation or reward was given to the participants. Parents could decide whether or not they would like to answer the specific questions: the questionnaire allowed the respondents to continue the survey without answering if they chose not to.

Statistical analysis

Descriptive statistics were used to examine distribution of the variables. A Chi-square test was used to examine the association between the demographic characteristics and intention to vaccinate a child/children with COVID-19 vaccine. Association between demographic variables and a mean attitude score was checked with a *t*-test for independent samples. The difference between parents who intended to vaccinate the child/children and those who did not intend in every item of the attitude questionnaire was assessed by the Mann-Whitney U non-parametric test. Spearman correlation was used to evaluate relationships involving ordinal variables: sources of influence on attitudes toward COVID-19 vaccine. Logistic regression was used to explore the antecedents of intention not to vaccinate a child with COVID-19 vaccine. Independent variables included parental age, gender, SES, profession, religiosity, adherence to the routine vaccination program of Ministry of Health and a social influence score. Nagelkerke R^2 value was used to analyze the contribution of all independent variables to the variability of the dependent variable. Before including independent variables in the multivariable analysis, correlations between the variables were checked with Kendall's Tau coefficient. Following high correlation between education and profession, education was not included in multivariable model. For all analyses performed, a $p < .05$ for a two-tailed test was considered statistically significant. Analyses were carried out with the SPSS version 25.0 statistical package (SPSS, Inc., Chicago, IL).

Ethical approval

The study received approval from the Ethical Board of the Department of Nursing, (Ashkelon Academic College). The survey was anonymous; no identifying data were collected. The questionnaire was delivered through Google Forms. After an introduction that explained the study objectives, participants were asked to confirm and agreed to participate.

Results

Participants

The study population included 138 parents; with mean age of 39 years (SD = 8.6 years); 55 (40%) of them worked in the healthcare sector, and 83 (60%) were from non-medical professions. Half of the parents had two children younger than 18 years old in both groups.

The proportion of secular/traditional parents was higher among healthcare workers vs. others (72.7% vs. 60.2%, not significant). The distribution of family income was similar in both groups. The proportion of highly educated parents holding MA or PhD degrees was significantly higher among healthcare workers than others (44.2% vs. 16.9%, $p = .001$). Additional demographic characteristics are shown in Table 1.

Intention not to vaccinate child

More than a quarter (26.6%) of parents reported that they did not intend to vaccinate their child/children with the COVID-19 vaccine. These parents were less educated (the proportion of those having only

Table 1
Demographic characteristics of the study population.

Demographic characteristics	Healthcare workers	Other	Total
	n = 55	n = 83	n = 138
Age (years)			
Mean (SD)	39.0 (8.1)	38.8 (8.9)	38.9 (8.6)
Median (Interquartile Range [IQR])	38.0 [32.0–46.0]	39.0 [30.0–46.0]	39.0 [32.0–46.0]
Gender (%)			
Female	70.9	56.1	62.0
Male	29.1	43.9	38.0
Family status “married or living with a partner” (%)	86.7	89.1	87.7
Number of children < 18 years old (median [IQR])	2.0 [1.8–3.0]	2.0 [1.0–3.0]	2.0 [1.0–3.0]
Level of religiosity (%)			
Secular/ Traditional*	72.7	60.2	65.2
Religious/ Orthodox**	27.3	39.8	34.8
Socio-Economic Status (%)			
Income <average wage in the economy	25.5	27.7	26.8
Income about the average	41.8	41.0	41.3
Income >average wage in the economy	32.7	31.3	31.9
Education (%)***			
School	7.7	27.3	19.4
Bachelor’s degree	48.1	55.8	52.7
Master’s degree/ PhD	44.2	16.9	27.9

* group of Secular/Traditional includes 81% secular and 19% traditional parents.
** group of Religious/Orthodox includes 88% religious and 12% orthodox parents.
*** p < .05

primary school education was 27.3% vs. 16.7% among others); they were less involved in the healthcare sector (33.3% vs. 42.2%), less religious (proportion of secular/traditional parents among them was 80.6% vs. 59.8%, p = .026). Among these parents, 47.2% did not vaccinate their child/children according to the routine vaccination program of the Ministry of Health (vs. 18.6% among others) (p = .001).

Other background characteristics (age, gender, family status) did not contribute to the differences between the two groups.

In the univariate analysis, lower religiosity and nonadherence to the routine vaccination program were associated with the intention not to vaccinate a child with COVID-19 vaccine (OR = 2.79, 95% CI: 1.12–6.96 for secular/traditional vs. religious parents and OR = 3.91, 95% CI: 1.72–8.89 for parents who do not follow the Ministry of Health program for routine vaccination vs. others, respectively). The social influence score was negatively associated with the intention not to vaccinate: elevation of one point in social influence score was associated with 2.5 fold decrease in odds for not vaccinating the child/children (OR = 0.40, 95% CI: 0.20–0.80) (Table 2).

Table 2
Analysis of Intention To Not Vaccinate Child With COVID-19 Vaccine: Results of the Logistic Regression Model.

Parents` Characteristics	Odds for not vaccinating the child with COVID-19 vaccine			
	Univariate Analysis		Multivariable Analysis	
	Odds Ratio (OR)	95% CI	Odds Ratio (OR)	95% CI
Age	0.99	0.94–1.04	0.99	0.94–1.04
Gender (female vs. male)	0.81	0.37–1.76	1.48	0.55–4.03
Socio-Economic Status (low vs. medium/high)	1.84	0.81–4.17	1.80	0.69–4.70
Number of children aged <18 years (1,2 vs. 3+)	1.10	1.01–1.19	1.07	0.96–1.19
Religiosity (secular/traditional vs. religious)	2.79	1.12–6.96	1.32	0.39–4.45
Profession (work unrelated to healthcare field vs. health professionals)	1.46	0.66–3.23	1.56	0.61–3.96
Vaccination according to Ministry of Health Program (no vs. yes)	3.91	1.72–8.90	4.82	1.83–12.71
Social Influence Score	0.40	0.20–0.80	0.31	0.13–0.73

In bold: p < .05.

Multivariable analysis (Table 2) reveals that parents who do not vaccinate their child/children according to the Ministry of Health program for routine vaccination have almost five-fold significant odds not to vaccinate a child with the COVID-19 vaccine (OR = 4.82, 95% CI: 1.83–12.71) independently of other parental characteristics. Other parental demographic characteristics were not associated with the intention not to vaccinate after mutual adjustment.

Social influence and intention not to vaccinate child with COVID-19 vaccine

Correlation between all sources of influence on attitudes toward the COVID-19 vaccine was positive and significant. The highest Spearman coefficients exceeded to 0.7 (p < .0001) for correlation between influence of family and friends, 0.6 (p < .0001) for the influence of friends and coworkers, and 0.6 (p < .0001) for the influence of friends and social media. Following the high correlation between the sources of influence and high reliability of the social influence questionnaire, the social influence score was constructed (as explained in the Methods), while the higher score represented higher social influence on attitudes toward COVID-19 vaccination of children. The score was distributed between 1 and 4 with a mean = 1.9 (SD = 0.6) and a median = 2.0 (IQR 1.5–2.3).

The mean social influence score was higher among parents who intended to vaccinate their child (2.0 vs. 1.7, p = .008). Studying the specific sources of social influences, the difference in the median social influence score between parents who intend to vaccinate a child and those who do not intend was significant for influence of the family, coworkers and media on attitude toward children's vaccination. The mean social influence score was higher among religious parents vs. secular/traditional (2.2 vs. 1.7, p < .0001). The mean social influence score was significantly higher among religious parents for every source, except for social media. Multivariable analysis (Table 2) revealed that the social influence score was negatively associated with the intention not to vaccinate: elevation of one point in the social influence score was associated with three-fold decrease in odds for not vaccinating the child/children (OR = 0.31, 95% CI: 0.13–0.73). After adding to the model social influence score, lower religiosity was no longer significantly associated with the intention not to vaccinate, which may represent a phenomenon of full mediation of the association between religiosity and intention not to vaccinate by social influence. SES, profession, age, and gender were not significantly associated with odds of not vaccinating a child with COVID-19 vaccine. This model explained 26% of variance in intention not to vaccinate the child/children.

The reasons for indecision and rejection of COVID-19 vaccine

As shown in Table 3, among the whole sample of parents, 63.8% reported fear of the side effects of the vaccine, 57.7% thought that there was not enough information about this vaccine for children, 54.0% had doubts about vaccinations in general, and 43.5% reported that their hesitation was associated with the fact that the vaccine was too new.

Table 3
The Reasons for Refusal to Vaccinate Children Against COVID-19 (N = 138).

The reasons	Strongly disagree	Disagree	Agree	Strongly Agree
	% of total population			
Vaccines to be produced for the COVID 19 virus can cause COVID-19 infection.	35.0	54.0	8.8	2.2
I am afraid of the side effects of the vaccine.	14.5	21.7	42.8	21.0
COVID-19 virus is a biological weapon and I think that the vaccine will serve those who produced this virus.	44.0	42.5	9.7	3.7
I don't think it can be reliable as it is the vaccine is too new.	22.5	34.1	29.7	13.8
I don't think that the vaccines produced for corona virus can be effective.	29.2	40.9	21.9	8.0
I don't think I have enough information about the COVID-19 vaccine	12.4	29.9	33.6	24.1
The COVID-19 infection is exaggerated, it is not a risky disease, so no vaccine is needed	34.6	42.6	16.2	6.6
I prefer other ways of protection.	24.1	32.1	31.4	12.4
I will not vaccinate my child as he already had COVID-19 virus.	34.6	47.4	13.5	4.5
I am waiting for vaccination until the child is a little older	31.9	39.3	22.2	6.7
In general, I have doubts about vaccinations.	19.0	27.0	32.1	21.9

Among parents who did not intend to vaccinate a child with the COVID-19 vaccine, 92% worried about possible side effects of the vaccine; 89% reported that their hesitation was associated with the fact that the vaccine was too new, 69% did not believe in its effectiveness, 92% thought that there was not enough information about this vaccine for children, 66% preferred to wait until the child was older, 28% believed that vaccination might cause COVID-19 and 31% thought that as SARS-Cov-2 was invented as a biologic weapon, and the vaccine might serve those who created the virus.

Parents' views on COVID-19 vaccination of children

The mean attitude score toward vaccination was distributed between 1 and 4 with a mean = 2.6 (SD = 0.7) and a median = 2.7 (IQR 2.0–3.1). Comparative analysis by intention to vaccinate children revealed interesting findings. As shown in Table 4, among parents who reported their intention not to vaccinate, the mean attitude score was significantly lower in comparison with those who reported intention to vaccinate (mean attitude score 1.7 vs. 2.9, $p < .0001$ (Table 4)). Only the item “COVID-19 vaccine for children may be accompanied by mild side effects such as fever, restlessness” was ranked similarly by both groups. The maximal difference was in two items reflecting the importance of COVID-19 vaccine on individual and social levels: “COVID-19

vaccine for children is important for the protection of my children, but also important for the health of those around my children” and “Vaccinating children against corona will reduce the duration and severity of the disease if my child gets sick”.

Parents who vaccinated their children in the past according to the national program for routine vaccination demonstrated more positive attitudes toward COVID-19 vaccination of children (M = 2.7 vs. M = 2.1, $p < .0001$). None of parental demographic characteristics were significantly associated with the attitude scores toward COVID-19 vaccine.

Discussion

The study aimed at examining parental attitudes toward COVID-19 vaccination of children aged 5–18, the concerns about vaccination and the intention to vaccinate children. In our sample of Israeli Jewish parents, about a quarter reported that they do not intend to vaccinate their children. This percentage is smaller than the proportion reported in an Israeli study from October 2021, in which 43% of parents claimed unwillingness to vaccinate their children against COVID-19 (Shmueli, 2021). The difference may be explained by the fact that in October, vaccination of children aged 5–11 was only a theoretical issue, while now, during the fifth wave of the pandemic with the advent of highly infectious Omicron variant of the coronavirus, almost 20% of this age group

Table 4
Difference in Specific Items Of Attitude Toward Vaccination Score Between Parents Who Intend to Vaccinate and Those Who Do Not Intend Vaccinate.

Number of Item	Attitude toward COVID-19 vaccination questionnaire	Intend to vaccinate	Do not intend to vaccinate	<i>p</i> value of Mann–Whitney <i>U</i> test
		Mean (SD)	Mean (SD)	
	Overall attitude score	2.9 (0.6)	1.7 (0.4)	<0.0001
1	COVID-19 vaccine is safe for children	2.9 (0.8)	1.6 (0.6)	<0.0001
2	COVID-19 vaccine for children may be accompanied by mild side effects such as fever, restlessness	2.7 (0.8)	2.5 (1.0)	0.562
3*	I am afraid of the side effects of vaccine	2.4 (0.8)	1.4 (0.6)	<0.0001
4*	The likelihood of side effects appearing as a result of the COVID-19 vaccine is a reason to avoid it	3.0 (0.8)	1.7 (0.7)	<0.0001
5	COVID-19 vaccine passed safety tests before being marketed for use	3.1 (0.7)	1.7 (0.7)	<0.0001
6	I trust the COVID-19 vaccine for children	2.9 (0.8)	1.4 (0.5)	<0.0001
7	Vaccines are one of the safest medical tools	3.1 (0.7)	2.4 (0.8)	<0.0001
8	Vaccines are an effective and safe tool developed and checked during medical studies	3.2 (0.6)	2.5 (0.8)	<0.0001
9*	COVID-19 vaccine was too quickly approved as a result of demand and funding	2.1 (0.7)	1.8 (0.8)	<0.0001
10	Despite the speed of approval of a vaccine against Corona, it has passed all the required tests	2.9 (0.7)	1.6 (0.6)	<0.0001
11	COVID-19 vaccine for children is very safe and I am not afraid of harm as a result of using it	2.7 (0.8)	1.3 (0.5)	<0.0001
12	I trust the production process of the COVID-19 vaccine for children	2.9 (0.7)	1.5 (0.6)	<0.0001
13	Even if my child develops a local side effect (redness, pain, swelling) I will know the COVID-19 is safe	2.8 (0.7)	1.5 (0.7)	<0.0001
14	Even if my child develops general side effects (fever, restlessness, vomiting, muscle aches and headaches) I will know the COVID-19 is safe	2.8 (0.7)	1.4 (0.6)	<0.0001
15	Long-term side effects as a result of COVID-19 are rare	3.1 (0.7)	2.0 (0.8)	<0.0001
16	The children's vaccination against COVID-19 will end the outbreak of an epidemic	2.6 (0.9)	1.5 (0.6)	<0.0001
17	Vaccinating children against the coronavirus is important for protection of the child against COVID-19	3.1 (0.8)	1.8 (0.8)	<0.0001
18	COVID-19 vaccine for children is important for the protection of my children, but also important for the health of those around my children	3.2 (0.7)	1.6 (0.8)	<0.0001
19	Vaccinating children against corona will reduce the duration and severity of the disease if my child gets sick	3.2 (0.8)	1.6 (0.8)	<0.0001

* coding of items 3, 4 and 9 was reversed.

have already been vaccinated (Ministry of Health, 2022a). In comparison, the rates of COVID-19 vaccine hesitancy among parents from Shandong and Zhejiang in China were 19.4 and 11.7% (Xu et al., 2021), in Italy 12.4% of parents reported vaccine hesitancy (Bianco et al., 2022), in Saudi Arabia 32% of parents reported that they would not vaccinate a child (Temsah et al., 2021).

The parents' tendency not to vaccinate was mainly related to intrapersonal factors, such as uncertainty and fear of risks associated with introduction of a new vaccine. This was reflected in the rankings of statements that refer to reliability of information about vaccination's influence on children, it's possible side effects and effectiveness. The same reasons for COVID-19 vaccine hesitancy or rejection among adults were found in the systematic review of 209 studies published worldwide (Cascini et al., 2021).

After taking into account age, gender, SES, profession and adherence to national routine vaccination program for children (but not the social influence score), the probability of vaccine rejection was significantly higher in our study among parents who were secular or traditional vs. religious. According to Jewish religious principles, a person has a duty to prevent harm to himself and his environment. In light of this orientation, religious and rabbinical organizations support vaccination in general, including childhood vaccination (Keshet & Popper-Giveon, 2021). On the other hand, the religious community in Israel is not monolithic but includes ultra-orthodox communities which tend to extreme segregation from the secular world in general and, in particular, from the rest of Israeli society (Okun, 2017) vs. national-religious community which promotes contact with the outside world while maintaining Jewish culture and practices (Be'ery et al., 2014). In addition, heterogeneity exists within these religious communities in beliefs or practices (particularly in health-related issues). Thus, lower children's routine vaccination coverage was reported in ultra-orthodox communities of Jerusalem in comparison with other Jewish population groups (Stein-Zamir & Israeli, 2019). Ultra-Orthodox Jews comprise 13% of the total Israeli population; this community is very young (58% of this population ages 0–19, compared to 30% among Jews who are not ultra-Orthodox) (Malach & Cahaner, 2018), making the issue of children's vaccination extremely important. The ultra-orthodox community needs special attention of public health practitioners and considering these needs brings results. Thus a task force was created by the Ministry of Health with the aim of increasing the compliance of the ultra-orthodox community with COVID-19 vaccination. The task force brought together trusted physicians and rabbinic leaders, and succeeded to address the concern about possible side-effects on fertility, which was the main barrier among young ultra-Orthodox women (Rosen, Waitzberg, Israeli, Hartal and Davidovitch, 2021; Schroeder et al., 2021). In this study the ultra-orthodox community was not well represented (only 4% of parents in the sample defined themselves as ultra-orthodox). Thus, religious parents in our sample represent the national-religious community, which is more open to new trends and to what the world has to offer (Be'ery et al., 2014). This religious community is less studied concerning vaccine hesitancy, probably because it is not at high risk for vaccination hesitancy as is the ultra-orthodox community.

Seeking the consultation of the religious leader (Rabbi) is highly acceptable in Jewish religious communities. For example, 63–77% of religious parents of sick children reported approaching their Rabbi to get medical advice (Shuper et al., 2000). In this study the mean influence score for Rabbi or community leader as having influence on attitude toward children's vaccination was significantly higher than among secular/traditional parents representing a strong intrapersonal factor among this community. Taking into account effort which had been made by public health professionals to enlist the support of religious leaders to vaccination program, this finding may at least partially explain the difference between religious and secular parents in our study in intention not to vaccinate, which was higher among the secular parents.

In general, religious groups in Israel are characterized by a strong sense of commitment to the community. For the religious person,

affiliation to a religious community is considered a key mechanism in promoting well-being since it provides people with a social identity and a sense of belonging, and also allows access to essential information, social activities, and social support (Russo-Netzer & Bergman, 2020). That may explain why after we included social influence in the multi-variable analysis, religiosity was no longer significantly associated with intention not to vaccinate a child. Healthcare policy makers should take these cultural aspects and tendencies into account when planning programs to increase population adherence to vaccination programs in general and the COVID-19 vaccination campaign in particular. Social influences are a primary factor in the adoption of health behaviors (Smith & Christakis, 2008). Compliance with diet, adherence to preventive screening recommendations, and maintenance of exercise routines all can depend on having contact with friends and family who also engage in these behaviors. Being a part of religious community was previously found as a protective factor against overall mortality: after accounting for individual and area SES, men and women living in religiously affiliated neighborhoods had lower mortality rates than those living in unaffiliated areas (Jaffe et al., 2005). The authors believe that the link between affiliation to a religious community and better health outcomes goes through promotion of healthy behaviors and attitudes, reduction of stress, and the formation of strong social bonds, all of which are strongly related to physical and mental wellbeing (Jaffe et al., 2005).

Adherence to Ministry of Health vaccination program for children was found to be another important factor significantly associated with the intention to vaccinate against COVID-19, while parents who were adherent to the routine vaccination program were also the ones who intended to vaccinate their child/children with the COVID-19 vaccine. This finding supports the previous evidence that parents tend to make the decision to vaccinate their children with a newly developed vaccine based upon attitudes and perceptions toward established vaccines (Hetherington et al., 2021; Humble et al., 2021; Lackner & Wang, 2021). Correspondingly, (Goldman et al., 2020) and (Temsah et al., 2021) reported that parents whose children were up-to-date on their scheduled vaccines were more willing to vaccinate their children against COVID-19.

In this study, healthcare workers were not statistically different from other parents in their intention to vaccinate children with COVID-19 vaccine or in their attitudes toward the COVID-19 vaccination. Healthcare workers would be expected to have more positive attitudes toward primary prevention strategies such as vaccination than the general population. An Italian study showed that physicians expressed higher willingness to receive vaccination against COVID-19 (Di Giuseppe et al., 2021). There is evidence that shows a disappointing trend of vaccine hesitancy among healthcare workers; in a Chinese study of 1332 doctors and nurses who had at least one child under the age of 18, only 44.5% reported that they would likely or very likely have their children under the age of 18 years take the COVID-19 vaccine among the general population (81.65%) was higher than that among healthcare workers (65.65%) (Wang, Yang, et al., 2021). Healthcare workers have a high rate of COVID-19 vaccination hesitancy: 4.3 to 72% (average = 22.5% across all studies with 76,471 participants worldwide) (Biswas et al., 2021). The majority of the studies found concerns about vaccine safety, efficacy, and potential side effects as top reasons for COVID-19 vaccination hesitancy among healthcare workers. As healthcare workers should be role models for disease prevention and they play important roles in reducing the burden of the pandemic, special communication and education strategies should be built specifically for this important population.

Practice implications

This study adds new and important information, which is needed for healthcare professionals in Israel and other countries in their effort to reach high anti-COVID-19 vaccination coverage. Thus, this study found

that interpersonal factors such as vaccination in the past as part of routine government immunization programs and positive attitudes toward vaccines in general and new COVID-19 vaccines in particular, predict a tendency to vaccinate children during the pandemic. Public health practitioners should address vaccine hesitancy in relation to routine vaccines. There are recommended approaches which can be used, such as motivational interviewing techniques to provide public health practitioners tools for work with vaccine-hesitant parents (MacDonald et al., 2018; Velan, 2016).

Additionally, our study emphasized the importance of acknowledging and targeting those parental beliefs and attitudes which highly related to parental intention not to vaccinate against Covid-19, in particular the concerns and uncertainty about the necessity of the vaccine, its side effects and reliability have been emphasized. This study draw attention to cultural-religious characteristics as playing an important role in shaping public opinion regarding vaccines and the decision to vaccinate children. When planning campaigns to increase vaccination for children, a comprehensive explanation of scientific validity and the side effects of the new vaccine should be provided together with an explanation of the risks of developing the disease in children as well as infecting others who may be at risk for serious morbidity and mortality. Cultural-religious adjustments should be applied when planning and implementing interventions and campaigns of this kind.

This study underlined the importance of different sources of influence as creating attitudes toward vaccination. Public health professionals should think about platforms which will make it possible to incorporate those parents who have vaccinated their children and have a positive attitude toward vaccination. It is important to provide the opportunity for these parents to share their opinions and even become "ambassadors" of vaccination in both their interpersonal relationships and social networks, since social influence has an important place in adopting a positive attitude toward vaccines. Rabbinical support of vaccination is crucial for increase in vaccination rates of children in religious communities.

Special focus should be given in future studies to unravel the way to improve attitudes toward COVID-19 vaccination among healthcare workers. As previous studies showed, healthcare workers are worried about the same vaccine-related issues as other participants. As rates of COVID-19 vaccination hesitancy in this population are high worldwide, education and policy-based interventions should be urgently aimed at this group to ensure their vaccination with the available COVID-19 vaccines. High compliance for COVID-19 vaccination among healthcare workers is crucial for the general public health.

Limitations

The limitations in this study may be related to the study sample characteristics and selection bias. First, a snowball sample limits the generalizability of the study findings; thus, ultra-orthodox parents were not represented in the sample. Generally, 64% of ultra-orthodox community used the internet in 2020 (compared to 93% among other Jewish Israelis) (Malach, 2021). Therefore, the recruitment of participants from ultra-orthodox community through the Internet may be limited. On another hand, the sample represented all SES levels and almost all main religious Israeli subgroups.

Second, the relatively small sample size may affect the reliability of the findings, e.g. difference between healthcare workers and other participants could not reach statistical significance.

Third, the sample represents only the Jewish Hebrew-speaking population. Future studies require an extension of the examination to additional populations that speak Arabic (Muslim or Christian Arabs), Russian (immigrants from Russia and Former Soviet Union countries) and Amharic (immigrants from Ethiopia).

Finally, recall and social-desirability biases in relation to routine vaccination of the child could distort the findings. On the other hand, previous studies found that the history of child vaccination was accurately

identified through maternal recall and concluded that it might be used to estimate the vaccination coverage (Binyaruka & Borghi, 2018; Hu et al., 2019). The complete anonymity of this study decreases the possibility of a social-desirability bias (Lelkes et al., 2012).

Conclusions

The study's findings highlight the importance of parents' attitudes regarding vaccines as a key to advancing children's immunization programs in routines and emergencies. Vaccination is a safe and effective tool in preventing COVID-19 in children, who may not only spread the virus in the population but also develop prolonged clinical symptoms (known as "long COVID"). Thus, every effort should be made to improve parental compliance with vaccination.

CRedit authorship contribution statement

Bella Savitsky: Resources, Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft. **Rachel Shvartsur:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Ilya Kagan:** Project administration, Supervision, Resources, Writing – review & editing.

Conflict of interest statement

All authors approve that they do not have any financial and personal relationships with other people, or organizations, that could inappropriately influence (bias) this research and this manuscript.

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