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# I have decided about my COVID-19 vaccine, what about my child?

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## ABSTRACT

Vaccination has been instrumental in controlling the COVID-19 pandemic, with numbers of new cases decreasing rapidly even as restrictions to control the spread of the virus were removed. The first stage of the vaccination campaign in Israel covered individuals aged 16 and older, following the U.S. Food and Drug Administration's approval of the vaccine. While the campaign was later extended to those aged 12 and older, some parents continue to have doubts and concerns about the vaccine. Data were collected via an online questionnaire during April 2021; 516 parents participated. This research adopted a holistic approach that combines factors relating to vaccine acceptance previously reported in the literature. The acceptance of pediatric COVID-19 vaccination among parents varied by their children's age groups, at 44.7%, 53.2%, and 66.4% among parents with children aged 0–6, 6–12, and 12–16, respectively. The results of this study indicate that different sets of variables affect the willingness of parents to vaccinate their children, depending on their child's age. Moreover, a holistic approach is necessary in order to correctly verify the significant variables. Parents who evaluate the vaccine as more beneficial have a higher probability of being willing to vaccinate. In addition, for ages 12–16, parental willingness to vaccinate is associated with access to information, trust, and neighborhood norms. Those evaluating information about the vaccine as more fake news show higher probability to vaccinate their children. The timing of the survey is highly relevant, especially considering the uncertainty about the effectiveness and side effects of the vaccine.

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## Introduction

The year 2020 will be remembered for the COVID-19 pandemic, caused by the SARS-CoV-2 virus, and its huge effect worldwide on people's quality of life and on economies.<sup>1</sup> The year ended with a glimmer of hope when the U.S. Food and Drug Administration (FDA) approved the use of the COVID-19 vaccination for individuals aged 16 and older. The vaccination campaign was a success, with the number of new infections declining rapidly despite the easing of lockdown restrictions in those countries that were able to get a high proportion of their population vaccinated. However, limitations concerning the unvaccinated population (mainly teenagers and children), both in and outside of school, were still needed, although children tend to have asymptomatic COVID-19 disease and a more favorable outcome than adults. Epidemiological data show that younger children are less susceptible to COVID-19 infection than older children and that they are less likely to transmit the infection. Nevertheless, the recent emergence of new variants could increase children's risk of transmitting the disease and their likelihood of suffering more severe disease.<sup>2–4</sup>

In May 2021, the FDA and European Medicines Agency's CHMP (Committee for Medicinal Products for Human Use) approved the use of the COVID-19 vaccine for children and teenagers aged 12 and older. Some countries have considered extending vaccination programs to children aged 12 to 16. They anticipate that this step will help in controlling the pandemic, which will be extremely important, especially given the

spread of new variants of SARS-CoV-2. Increasing the vaccination rate will help in reaching herd immunity and will aid in the recovery of the global economy. To implement such a strategy, it is important to understand parents' willingness to vaccinate their children, as parents are usually the decision makers in this matter.

In Israel, the COVID-19 vaccination campaign began in mid-December 2020, and by the time of the survey, 54.6% of the population were fully vaccinated;<sup>5</sup> by August 2022, 66.2% of the population was fully vaccinated. By the date this survey was conducted, the highest number of new infections per day was 8624; on 17 January 2021, based on the 7-day rolling average. This number gradually declined as the proportion of the vaccinated population increased to just 15 new cases per day at the beginning of June 2021. However, due to the new, more transmissible Delta variant of SARS-CoV-2, the average number of new cases per day increased to 450 at the beginning of July. Based on a nationwide observational study conducted in Israel,<sup>4–6</sup> the vaccine's effectiveness against symptomatic SARS-CoV-2 infection, COVID-19-related hospitalization, and COVID-19-related death exceeded 96% across all age groups. There is a positive correlation between the vaccination coverage rate and age: in those aged  $\geq 70$ , 50–70, and 20–40, the rates were >95%, 90%, and 80%, respectively. The percentage of people vaccinated in Israel appears to have reached a plateau; recently, individuals receiving their first dose of vaccine increased by just 2.3%, from 60.7% in April 2021 to 63% in June 2021.<sup>5–8</sup> This phenomenon has

also been observed in other countries and is probably a result of a vaccine hesitancy.<sup>9–11</sup>

There is some debate concerning the necessity of vaccinating children against COVID-19, especially given the low level of new infections in countries with a high rate of vaccination on the one hand, and the emergence of more contagious variants on the other. COVID-19 vaccination has been shown to provide substantial protection to unvaccinated members of a household but is not as effective as if they had been vaccinated themselves.<sup>9–13</sup> If herd immunity is to be achieved, it will be necessary to add children to the vaccinated group.<sup>14–16</sup>

From 6 June 2021, the vaccination campaign in Israel included individuals aged 12 and older, but vaccination has been voluntary and there are no medical recommendations for children to be vaccinated unless they are in a high-risk group or are planning to travel to other countries.

The aim of this research is to explore parents' intentions to vaccinate their children against COVID-19 and to identify the determinants of their decision about vaccination in order to assist in the development of vaccination program strategies. Most previous research relates to vaccination of adults and was performed before the vaccine was available and approved. This research concerns parents' decisions regarding vaccination of their children after most of these parents have received the vaccine themselves and since approval was granted for child vaccination.

## Material and methods

### Study design and population

This research is based on a holistic approach and covers three categories of variables: (1) contextual influences (demographic variables such as gender, age, and income); (2) health records (e.g., health status, being sick with COVID-19, being in isolation, following COVID-19 instructions, vaccine acceptance); and (3) perceived health attitudes (e.g., information, trust, doctor recommendations, neighborhood norms, health belief model constructs, and the influence of COVID-19). An online questionnaire was distributed between 27 and 30 April 2021 among 516 parents aged 18 or older and who lived in Israel. This took place after the FDA and Canadian authorities had approved vaccination for those aged 12 and older, but before the Israeli Ministry of Health had approved vaccinations for children in Israel. This study was approved by the Ethics Committee at the higher education institution with which the authors are affiliated.

The study was conducted by IPANEL, a polling company, using an internet survey in Hebrew. The polling company manages the largest online panel in Israel, with about 100,000 members and offers access to thousands of population segments. The polling company is a member of ESOMAR and operates in accordance with the guidelines of the organization's quality standards. The randomly selected members from all areas in Israel receive a link to a questionnaire and can choose whether to answer the questions. The respondents receive points for each survey they fill in and can later exchange those points for a gift card to redeem at certain shops.

At the end of the year 2020, there were 3,049,000 children aged 0–17 in Israel, with an average of 2.45 children for

a family with children. The relevant population is about 2.4 million and the sample size needed for a 95% confidence level and 4.4 confidence interval for this population is 496.<sup>17</sup> A total of 4,589 links to the survey were sent to the panel members, 1,130 answered the survey, of which 516 were valid. The low percentage of completed questionnaire is due to: unactive members, addressing member that did not have children at this age groups, some that clicked the link but did not complete the survey or full gender quota.

### Questionnaire design

The questionnaire used in this study was based on various previous designs and included several sections.<sup>18–27</sup> Section 1 included demographic data (age, gender, level of income, education, ethnicity, and level of religiousness). Section 2 included questions regarding the effects of COVID-19 on respondents' economic status, health status, mental health, and daily routine; responses were recorded using a scale of 0 (*had no effect at all*) to 100 (*had a very strong effect*). Section 3 included: respondents' family health status; willingness to vaccinate children of different ages against COVID-19; attitudes toward avoiding exposing children to crowded places and other people; having relatives infected with COVID-19; whether they, their spouse, or their children receive influenza vaccinations; children's vaccination history; parental vaccination status for COVID-19; the number of times their children were in isolation; and degree of following government instructions. Section 4 included respondents' perceptions of data concerning COVID-19: trust, information, frequency of news updates, fear, doctor's recommendations, fake news, neighborhood norms, vaccine and child vaccine information evaluation, and the four constructs of the health belief model (susceptibility, severity, benefits, and barriers), using a 5-point Likert scale ranging from 1 (*do not agree at all*) to 5 (*very much agree*). A detailed list of the independent variables and their values is shown in Appendix.

### Study methods

The dependent variable, willingness to vaccinate children against COVID-19 when the vaccine becomes available, was measured using a five-point Likert scale ranging from 1– will defiantly not vaccine the children – to 5 – will defiantly vaccinate the children. There was a separate analysis for each age group: less than 16 years old but more than 12 years (denoted by 12–16), less than 12 years old but more than 6 years (denoted by 6–12), and less than 6 years old (denoted by 0–6). This division of age groups is necessary because at the time the survey took place, the vaccine was approved only for ages 12 to 16. Additionally, the younger age group was separated into two groups, 0–6 and 6–12, because there are differences in educational institutions, e.g., schools and kindergartens, regarding class size, institution size, activities, and the ability to practice social distancing. Descriptive statistical and normal distribution tests of the willingness to vaccinate for each age group were made and the correlation between the willingness to vaccinate children from the same family in different age groups was calculated. Since the dependent variables were

not normally distributed, a new set of binary variables was created. In the Likert scale measurement, those who responded that they will definitely or probably vaccinate their children received the value 1 for the new variable, and zero for all other Likert points.

To analyze the willingness to vaccinate a separate model was performed for each category of the independent variables: (1) contextual influences, (2) health records, and (3) perceived health attitudes separately, and for all of them together. The best logistic regression models were fitted by the Wald backwards regression.

## Results

**Table 1** describes the demographic variables for parents differentiated by the children's age: 12–16 ( $n = 131$ ), 6–12 ( $n = 220$ ) and 0–6 ( $n = 340$ ). Some parents belong to more than one age group: 28 parents had children in all the three age groups and 144 in two age groups. The mean age of the parents in the sample was 38.2 years. In the subsample with children aged 0–6, there were slightly more females than males, with similar proportions in the other age groups. More than 80% of the sample was secular or conservative. The annual income of more than 48% of respondents in the subsample with children aged 0–6 was lower than the average for Israel; the annual income of about 35% of the other two subsamples was lower than average. The percentage of respondents with graduate degrees was more than 20%.

**Table 1.** Descriptive statistics.

Variable		Ages 12 to 16 (N = 131)	Ages 6 to 12 (N = 220)	Ages 0 to 6 (N = 340)
Gender	Male	50.4	48.6	44.4
	Female	49.6	51.4	55.6
Religiousness	Secular	44.3	43.2	41.2
	Conservative	38.2	41.4	37.9
	Orthodox	17.6	13.6	17.9
Income	Strict orthodox	0	1.8	2.9
	Well above average	3.8	5	5.3
	Above average	26.7	26.4	18.8
	Average	35.1	30.9	27.9
Education	Below average	22.9	26.4	27.1
	Well below average	11.5	11.4	20.9
	High school	15.3	15.9	27.5
	Professional diploma	24.4	23.6	22.3
	Bachelor's degree	38.2	36.8	37.9
	Graduate degrees	22.2	23.7	20.3

With regard to the COVID-19 vaccination, at the time of the survey, for the age groups of 6–12 and 12–16, about 85% of respondents reported that both parents were vaccinated, and for the age group of 0–6, 78% of parents were vaccinated. About 7–8% of the parents of children aged 6–12 and 12–16, respectively, reported that neither parent was vaccinated, while 12% of parents of children aged 0–6, did not vaccinate.

**Table 2** shows the distribution of parents' intention to vaccinate all their children, differentiated by child age. The intention to vaccinate children (regardless of age) was 3.49 (out of 5), which indicated that most parents viewed vaccination positively, but were still not certain about the vaccine. The intention to vaccinate decreased as the age of the children decreased. For parents with children aged 12–16, 66.4% of the population positively considered vaccinating their children. This decreased to 53.2% and 44.7% for those with children aged 6–12 and 0–6, respectively. On the other hand, 30.3% of parents with children aged 0–6 considered vaccinating their children negatively. This percentage decreased to 15.9% and 7.6% for parents with children aged 6–12 and 12–16, respectively. The percentage of parents who were undecided was similar for parents of all age groups. In addition, for families who had children in more than one age group, a significant positive Pearson correlation was found between their intention to vaccinate the children in different age groups (**Table 2**).

**Table 3** shows associations between contextual variables and the intention to vaccinate children. The results for parents of children aged 0–6 indicated that men had a higher probability than women of positively evaluating their willingness to vaccinate their children. A higher level of education was associated with a decreased probability of positively evaluating the willingness to vaccinate children aged 12–16.

**Table 4** shows the association between health record and behavior and the parents' intention to vaccinate their children. The results indicated that parents who were themselves vaccinated against COVID-19 had a higher probability of positively evaluating their willingness to vaccinate their children. This was the variable that had the highest influence. Parent of children aged 0–6 who were vaccinated against influenza had a higher probability of positively evaluating their willingness to vaccinate their child against COVID-19. The effects of the other variables were not found to influence the intention to vaccinate, except for voluntary COVID-19 avoidance behavior for children aged 6–12.

**Table 5** shows the associations between perceived health attitudes and parents' intentions to have their children

**Table 2.** Intention to vaccinate children: distribution and correlations.

	Intention to vaccinate children					Mean (SD)	Correlation		
	5 Yes (%)	4 Probably yes (%)	3 Have not decided (%)	2 Probably no (%)	1 No (%)		Ages 12 to 16	Ages 6 to 12	Ages 0 to 6
Ages 12 to 16 N = 131	45.8	20.6	26	3.8	3.8	4.01 (1.11)	-	0.843**	0.8**
Ages 6 to 12 N = 220	31.4	21.8	30.9	9.1	6.8	3.62 (1.21)	-	-	0.872**
Ages 0 to 6 N = 340	22.1	22.6	25.0	15.0	15.3	3.21 (1.35)	-	-	-

\*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 3.** Associations between contextual variables and the willingness to vaccinate children.

Variable	Ages 12 to 16		Ages 6 to 12		Ages 0 to 6	
	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	2.63**	0.867	0.4*	0.2	1.4	0.72
Ethnic origin						
Gender	-0.73	0.387	-0.52	0.273	-0.76**	0.23
Age					-0.034	0.019
Religiousness						
Income						
Education	-0.29*	0.14				
	Nagelkerke $R^2 = 0.072$ ; $Chi^2 = 7 P = .03$		Nagelkerke $R^2 = 0.022$ ; $Chi^2 = 3.69 P = .055$		Nagelkerke $R^2 = 0.047$ ; $Chi^2 = 12.04 P = .002$	

\* $P < .05$  \*\* $P < .01$  \*\*\* $P < .001$ .**Table 4.** Associations between the health record, behavior variables and the willingness to vaccinate children.

Variable	Ages 12 to 16		Ages 6 to 12		Ages 0 to 6	
	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	-0.54	0.61	-52.19*	20.13	-1.35**	0.46
Health status						
Covid-19 sick			-0.48	0.29		
Avoid			0.52*	0.2		
isolation			0.17	0.11		
Influenza vaccine					0.83**	0.27
Follows instructions						
Child vaccine						
Parents Covid-19 vaccine	1.39*	0.66	1.51**	0.55	1.83***	0.45
	Nagelkerke $R^2 = 0.048$ ; $Chi^2 = 0.456 P = .032$		Nagelkerke $R^2 = 0.148$ ; $Chi^2 = 25.8 P = .000$		Nagelkerke $R^2 = 0.149$ ; $Chi^2 = 40.18 P = .000$	

\* $P < .05$  \*\* $P < .01$  \*\*\* $P < .001$ .**Table 5.** Associations between perceived health attitudes and the willingness to vaccinate.

Variable	Ages 12 to 16		Ages 6 to 12		Ages 0 to 6	
	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	-22.42***	5.84	-5.4**	1.69	-8.96***	1.21
Knowledge						
Update frequency					-0.32	0.18
Fake news	1.04*	0.44				
trust	3.44*	1.6				
Doctor recommendation					0.69**	0.24
Influence						
Susceptibility			-0.34	0.2		
Severity	-1.12	0.59			-0.96**	0.29
Benefits	2.5**	0.94	2.06***	0.35	2.73***	0.39
Barriers			-0.71*	0.28		
Fear						
Neighborhood norms	1.99*	0.78				
Vaccine knowledge type	-0.07*	0.03				
Child vaccine knowledge type	0.073**	0.03	0.03**	0.01	0.02*	0.01
	Nagelkerke $R^2 = 0.79$ ; $Chi^2 = 109.73 P = .000$		Nagelkerke $R^2 = 0.65$ ; $Chi^2 = 145.18 P = .000$		Nagelkerke $R^2 = 0.61$ ; $Chi^2 = 205.74 P = .000$	

\* $P < .05$  \*\* $P < .01$  \*\*\* $P < .001$ .

vaccinated against COVID-19. The results show that the intention to vaccinate children was higher among those who considered the vaccine as more beneficial. Those who evaluated the information about the vaccine as supporting child vaccination had a higher probability of positively evaluating their willingness to vaccinate their children. The probability of positively evaluating the willingness to vaccinate increased for those who considered the vaccine to have fewer barriers for children aged 6–12. Parents of children aged 0–6 who see the virus as a threatening disease

(severity) had a lower probability of positively evaluating their willingness to vaccinate their children. Conversely, those that received a doctor's recommendation had a higher probability of positively evaluating their willingness to vaccinate. Parents of children aged 12–16 had a higher probability of positively evaluating their willingness to vaccinate their children if they had more trust in the vaccine, if they evaluated some of the news as fake news, and if the neighborhood norms supported the vaccine. If those parents evaluated the information about the

**Table 6.** Final model of parents' willingness to have their children vaccinated against COVID-19.

Variable	Ages 12 to 16		Ages 6 to 12		Ages 0 to 6	
	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	126.88	69.11	-12.1***	2.36	-7.46***	1.49
age			0.08*	0.03	-0.6*	0.03
Education						
avoid	-1.42*	0.64				
Fake news	-1.61*	0.76				
trust	2.19**	0.81				
Parents vaccine					1.19*	0.6
Update frequently					-0.34	0.19
Doctor recommendation			0.65*	0.33	0.65**	0.25
Susceptibility	-0.76	0.46	-0.4	0.21		
Severity	-1.84*	0.87	-0.84*	0.38	-1.08***	0.31
Benefits	4.24**	1.47	2.00***	0.49	2.75***	0.41
Neighborhood Norms	3.65**	1.29	0.81	0.45		
Vaccine knowledge type	-0.1*	0.04				
Child vaccine knowledge type	0.08*	0.03	0.03*		0.02**	0.01
	Nagelkerke $R^2 = 0.85$ ; $Chi^2 = 123.15 P = .000$		Nagelkerke $R^2 = 0.675$ ; $Chi^2 = 154.8 P = .000$		Nagelkerke $R^2 = 0.62$ ; $Chi^2 = 213.39 P = .000$	

\* $P < .05$  \*\* $P < .01$  \*\*\*  $P < .001$ .

vaccine as supporting vaccination they had a lower probability of positively evaluating their willingness to vaccinate their children.

The final model represented in Table 6 was based on a holistic approach that combined the different determinants into an extended model. For parents of all age groups, those who considered the vaccine more beneficial or evaluated the information regarding child vaccination as supporting the vaccine had a higher probability of positively evaluating their willingness to vaccinate their children. On the other hand, those parents who had more concerns about the severity of the disease had a lower probability of positively evaluating their willingness to vaccinate. For children aged 12–16, the significant variables also included avoiding visiting crowded places, level of parental education, the parents' level of trust in the vaccine, the parents' tendency to view information as fake news or evaluate the information regarding vaccine as being supportive of the vaccine, and whether the neighborhood norms supported the vaccine. For children aged 6–12 or 0–6, the significant variables also included doctors' recommendations and age. Parents who received recommendations from doctors had a higher probability of positively evaluating their willingness to vaccinate their children. In the age group of 0–6, the parents' experience with the COVID-19 vaccine was also significant.

## Discussion

The COVID-19 pandemic has led to major economic and social crises around the world. For countries with a high level of vaccination uptake, the effectiveness of the COVID-19 vaccine has been demonstrated by the sharp decline in new cases and a return to life without restrictions. Although vaccinating children is routine and widely accepted for various diseases, e.g., measles, polio, mumps, and diphtheria, there are certain scientific, moral, and ethical dimensions concerning the vaccination of children against COVID-19. During the period prior to the introduction of the COVID-19 vaccine, the infection rate among children was considerably lower than the rate among

people aged 70 or more. At the time the study was performed, this trend had reversed, and most new cases were in children. In addition, given the surge in more transmissible variants, vaccination is increasingly critical if herd immunity is to be achieved. Infections in younger people are nearly always mild or asymptomatic, and those in this age group are less likely to suffer severe illness and death as a result of contracting SARS-CoV-2; the death rate in children is just 2 per million.<sup>3</sup> The moral concern arises from the limited supply of vaccines, with WHO advising that wealthy countries should postpone their plan to immunize children and allow the rest of the world have access to the vaccines. Additionally, there is some evidence of heart muscle inflammation post-vaccination, especially in young men, at rates higher than expected by the vaccine companies. Other side effects are similar for children and adults.

The United States, Singapore, Japan, the UAE, China, Canada, Philippines, almost half of the countries in Europe, and Israel have all decided to vaccinate children aged 12 to 15.<sup>28</sup> The United States has the largest proportion of children vaccinated, with 21.1% of children fully vaccinated by 29 June 2021.<sup>28</sup>

The timing of a survey is critical when dealing with willingness to vaccinate, and most of the research around COVID-19 vaccination for children was performed prior to the start of the vaccine campaign for adults. Parents may take a different view of the vaccine after having their own experience with the vaccine and could potentially have fewer doubts about the vaccine's effectiveness and side effects. The present study was performed before the vaccine was approved in Israel for children but after the FDA and the European Union had approved the COVID-19 vaccine for children aged 12 and up. The novelty of the research is the use of a holistic approach that combines previously identified factors found in the literature. Many variables were found to be significant. In each analysis, the significant variables are different, depending on the set of the research variables. The vaccine policy must focus on the small number of variables which are the most influential ones; a holistic approach will be able to identify them. Moreover, it distinguishes parents' intention to vaccinate their children

among three populations: children younger than school age (aged 0–6), children in elementary school (aged 6–12), and children in middle school (aged 12–16).

The acceptance of the COVID-19 vaccine among parents varied according to their children's age group: 44.7%, 53.2%, and 66.4% for children aged 0–6, 6–12, and 12–16, respectively. Previous studies that assessed children's vaccination acceptance rates showed extremely heterogeneous results: in China in September 2020 the rate was 72.6%;<sup>26</sup> in Australia in June 2020, 75.8%;<sup>29</sup> 60.4% in Italy in December 2020 and January 2021;<sup>30</sup> 64% in Canada in August 2020;<sup>31</sup> and 89.1% in the UK in April to May 2020.<sup>23</sup>

Our results indicate that between 25–31% of parents in Israel (depending on the age group) had not yet made a decision whether to vaccinate, compared with 29.6% in Italy,<sup>30</sup> 17% in Canada,<sup>31</sup> and 16.7% in Australia.<sup>29</sup> The percentage of parents who negatively considered the vaccination for children aged 0–6 years was 30.3%, which decreased to 15.9% and 7.6% for children aged 6–12 and 12–16, respectively. In Canada, 19.1% of parents negatively considered the vaccine,<sup>31</sup> in Australia this proportion was 7.6%,<sup>29</sup> and in Italy it was 9.9%.<sup>30</sup>

The results of this study indicate that different sets of variables affect parents' willingness to vaccinate children according to the age of their child age. Moreover, variables that were found to have a significant effect on the probability of positively evaluating the willingness to vaccinate in some sub-set of variables (e.g. contextual) may be irrelevant concerning all the variables together. In contrast, some variables that were not significant in some contextual variables were significant when all the variables together were considered. Variables that belong to the first group are gender, influenza, and barriers. Variables that belong to the second group are: age and education. For children aged 0–6, fathers have a higher probability than mothers to positively evaluate their willingness to vaccinate their children. Similar results were found in Italy.<sup>30</sup> These results are also in line with the higher level of vaccine hesitancy among women regarding having the COVID-19 vaccine themselves.<sup>20,24,32</sup> In addition, for the same age group parents who allow their children to receive the influenza vaccine have a higher probability of positively evaluating their willingness to vaccinate their children against COVID-19. This result is similar to results reported in Canada<sup>31</sup> and in an international cross-sectional survey.<sup>24</sup> Parents of children aged 6–12 who worried about the vaccine outcome (barriers) have a lower probability than mothers to positively evaluate their willingness to the vaccinate their children.

Considering all of the above factors together in one model yielded the finding that for all the age groups, the vaccine's benefits was one of the most influential factors on the probability of positively evaluating the willingness to vaccinate. Similar results were found regarding COVID-19 adult vaccination.<sup>3,19,20</sup> In addition, for ages 12–16, the variables that had the highest effect were: trust in information, neighborhood norms, and evaluation of some of the information as fake news. For children aged 0–12, the effecting variables were doctors' recommendations and severity. The decision of the parent to vaccinate themselves has a major impact on the probability of vaccinating children under 6-years-old.

A similar result was found in Canada regarding the relationship between the intent of parents to receive the vaccine themselves and to have their child vaccinated.<sup>31</sup>

Similar analyses to those described here were used to determine the factors among adults in Israel that affect their intention to have the COVID-19 vaccination. The intention to have the vaccine in adults was dependent on their gender, age, income, level of religiousness, influenza vaccine, trust, susceptibility, benefits, barriers, and influence.<sup>33</sup>

Those results that differ from those of previous research may be attributable to the timing of the survey, which took place once most adults had been vaccinated against COVID-19 and the rate of new cases had significantly declined. Most of the previous research had been carried out before the vaccine became available, when the number of new cases and death were increasing each day. In addition, people's concerns about the vaccine's effectiveness and side effects had declined and trust in the vaccine had increased. Moreover, the parents' decision to vaccinate themselves may override the role of other demographic and health behavior factors.

Government and health institutions should continue the adult vaccination campaign alongside the child vaccination campaign, highlighting the benefits of the existing vaccines and focusing on the fact that the vaccine can return life to its normal routine, rather than present the vaccine as a firewall against a difficult disease.

For parents of children aged 12–16, the campaign should target those that do not trust the system and who live in neighborhoods that do not support the vaccine. The campaign must show the errors in fake news. For parents of younger children, the focus should be on the vaccine's benefits and the campaign must recruit doctors to recommend the vaccine to the parents.

The fact that this study was performed in just one country and involved a relatively small sample size may be a limitation. In particular, the number of parents who were against the COVID-19 vaccination for their children aged 12–16 was very small. However, our findings can shed light on factors that affect parents' intentions to vaccinate their children against COVID-19 and other diseases, such as influenza, or with other vaccines that may be developed in the future.

Further research should be conducted to examine this phenomenon in other countries. This research should also focus on respondents who are vaccine hesitant, i.e., those who have doubts about vaccination or have simply not yet decided.

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## Availability of data and material

[https://figshare.com/articles/dataset/covid19\\_child\\_vaccine/15147021](https://figshare.com/articles/dataset/covid19_child_vaccine/15147021).

## Ethical approval statement

The research was approved by the Yezreel Valley college ethical committee. YVCEMEK 2021-91.

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## Appendix

Variable name	Scale	Variable description
Gender	0 = Male 1 = Female	
Age		Respondent age in years
Income	1 = Well above average 5 = Well below average	Respondent income from 1 to 5
Education	1 = High school 2 = Diploma 3 = Bachelor's degree 4 = Higher degree	Highest level of education
Religiousness	1 = Secular 2 = Conservative 3 = Orthodox 4 = ultra-Orthodox	Level of religiousness
Ethnicity	0 = Jewish 1 = Arab	
Health status	4 = Excellent 1 = Poor	Rate your family's health status, 1 to 4
Follows instructions	5 = Very much 1 = Not at all	Degree of adherence to government guidelines for COVID-19
COVID-19 sick	1 = Yes 0 = No	Has anyone around you had COVID-19?
Avoid Cronbach alpha = 0.828	100 = Very much 1 = Very little	To what degree do you avoid going to crowded places with your children? To what degree do you avoid exposing your children to people outside their immediate circle?
Isolation Cronbach alpha = 0.82		How many times were your children aged 0 to 6 in isolation? How many times were your children aged 6 to 12 in isolation? How many times were your children aged 12 to 16 in isolation?
Child vaccine	1 = Yes 0 = No	Do your children receive routine childhood vaccines?
Influenza vaccine Cronbach alpha = 0.831	1 = Yes 0 = No	Did you receive the influenza vaccine? Did your spouse receive the influenza vaccine? Did your children receive the influenza vaccine?
Parents COVID-19 vaccine Cronbach alpha = 0.772	1 = Yes 0 = No	Did you receive the COVID-19 vaccine? Did your spouse receive the COVID-19 vaccine?
Information	5 = Very much 1 = Very little	How much do you know about COVID-19?
Update frequency	4 = Several times in a day 3 = Daily 2 = Weekly	How often do you read or hear news about COVID-19?
Fake news	1 = I don't update 4 = More than 10% 3 = 5 to 10% 2 = 1 to 5% 1 = less than 1%	What percentage of the news do you classify as fake news?
Trust Cronbach alpha = 0.753	4 = Fully trust 1 = Do not trust at all	What is your level of trust in vaccine information? What is your level of trust in data from the companies that developed the vaccine?
Susceptibility	5 = High probability 1 = Low probability	The possibility of children to get sick.
Severity Cronbach alpha = 0.812	5 = Severe outcome 1 = No outcome	If my children get COVID-19, it will disturb my family If my children get COVID-19, it will be hard for them to perform everyday activities COVID-19 can be a serious disease that children can die from COVID-19 is more dangerous than a virus COVID-19 can be a difficult disease for my children
Benefits Cronbach alpha = 0.95	5 = Vaccine has benefits 1 = Vaccine has no benefit	The vaccine for COVID-19 is a good way to protect my kids from getting sick. It is important to vaccinate children as the vaccine has been shown to be successful. The vaccine is important to the health of my child. The vaccine is beneficial for children. The vaccine is important to get herd immunity. Giving my child the vaccine is important to people around me. It is important to vaccinate the children so they can return to school. The vaccine for COVID-19 makes me less worried about my children getting the disease. The vaccine is effective for children.
Barriers Cronbach alpha = 0.842	5 = Worries 1 = No worries	The vaccine for COVID-19 is new so I am not sure it is safe to use. I am worried about the safety of the COVID-19 vaccine. I am afraid the vaccine will be effective for a short time only. I am afraid of short-term side effects of the COVID-19 vaccine. I am afraid of long-term side effects of the vaccine for COVID-19. I am afraid the vaccine for COVID-19 can cause fertility problems.
Fear Cronbach alpha = 0.869	5 = Very much agree 1 = Do not agree at all	The possibility that my child will get COVID-19 is very frightening. I am worried that my children will get COVID-19.

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(Continued).

Variable name	Scale	Variable description
Neighborhood norms Cronbach alpha = 0.815	5 = Very much agree 1 = Do not agree at all	People around me plan to vaccinate their children. People who are important to me are pro-child vaccination. I will have family support if I decide to vaccinate my child.
Influence Cronbach alpha = 0.735	1 = No influence 100 = High influence	Rate the effect of COVID-19 on your life. Rate the effect of COVID-19 on your economic situation Rate the effect of COVID-19 on your medical situation. Rate the effect of COVID-19 on your mental situation.
Doctor Cronbach alpha 0.865	5 = Very much agree 1 = Do not agree at all	A recommendation from the pediatrician is reliable and can be trusted. I will vaccinate my child if I receive a recommendation from the pediatrician.
Vaccine information type	1= against vaccine 100= pro-vaccine	How would you rate the information regarding the COVID-19 vaccine?
Child vaccine information type	1= against vaccine 100= pro-vaccine	How would you rate the information regarding the COVID-19 vaccine for children?