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

**Abstract**

**Background**

The COVID-19 pandemic has led to major economic and social crises globally. Vaccination has been instrumental in controlling the 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 covered individuals ages 16 years old, according to APA approval. The campaign was recently extended to those aged 12 years old and upwards, but there is vaccine hesitancy among some parents. While there is research to suggest broad acceptance of COVID-19 vaccination, most of this research concerned adults and was conducted before the vaccine was made available. It is important to investigate attitudes among parents towards vaccinating their children, especially once parents have experienced the vaccine for themselves.

**Methods**

Data were collected via an online questionnaire during April 2021; 516 parents participated. This research adopted a holistic approach that combines factors previously reported in the literature.

**Findings**

The acceptance of COVID-19 vaccination varied, at 44·7%, 53·2%, and 66·4% among parents with children aged 0–6, 6–12, and 12–16 years, respectively.

**Interpretation**

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. The willingness to vaccinate children is associated with parents’ experience with COVID-19, judge the knowledge as pro child vaccine, benefits, barriers and severity. There is no additional explanation effect for the demographic and the health record and behaviour factors above those concerning COVID-19.

The results prove that the timing of the survey is curtail especially after own experience with the vaccine, have more information about the effectiveness and side effects of it. Parents’ decision to have the vaccines themselves may substitute the role of the demographic and the health behaviour record aspects.

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**Keywords**

Child, vaccine hesitancy; COVID-19; Health Belief Model; parent vaccination, type of vaccine information.

**Declarations**:

**Conflicts of interest/Competing interests**: The authors have no conflicts of interest to declare that are relevant to the content of this article.

**Availability of data and material** (data transparency)

**Code availability:** Not applicable

**Research in context**

**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 human quality of life and economics. The year ended with a glimmer of hope when the FDA approved the use of COVID-19 vaccination for individuals aged 16 years and upwards. 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, limitation concerning unvaccinated population (mainly teenagers and children) activities both in school and outside are still needed. Children tend to have asymptomatic COVID-19 disease and a more favourable outcome than adults. Epidemiological data show that younger children are less susceptible to COVID-19 infection than older children and they are less likely to transmit the infection. However, the recent emergence of new variants could increase children’s risk of transmitting the disease and their likelihood of suffering more severe disease.[1],[2],[3]

In May 2021, the FDA and CHMP approved the use of the COVID-19 vaccine for children and teenagers aged 12 years and upwards. Some other countries have considered extending vaccination to children aged 12 to 16 years. They anticipate that this step will help to control 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 aid the recovery of the global economy. To imply such a strategy, it is important to understand parents’ vaccine hesitancy when it comes to vaccinating 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 3 June 2021, 59·35% of the population were fully vaccinated. The highest number of new infections per day was 8624, based on the 7-day rolling average, on January 17 2021. 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 week increased to 450 at the beginning of July. Based on a nationwide observational study conducted in Israel, the vaccine’s effectiveness against symptomatic SARS-CoV-2 infection, COVID-19-related hospitalisation, and COVID-19-related death exceeded 96% across all age groups. There is a positive correlation between the vaccination rate and age: in those aged ≥70, 50–70, and 20–40 years 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.[4], [5], [6]This phenomenon has also been observed in other countries and is probably a result of a vaccine hesitancy. Vaccine hesitancy is defined by the World Health Organization (WHO) as a delay in acceptance or refusal of vaccination, despite the availability of vaccination services.[7] The causes of vaccine hesitancy vary by country and are vaccine-specific, indicating a need to strengthen the capacity of national vaccination programmes to identify local causal factors and develop appropriate strategies to deal with this issue.[8], [9]

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.[10], [11], [12], [13], [14] If herd immunity is to be achieved, it will be necessary to add children to the vaccinated group.[15], [16], [17]

From 6 June 2021, the vaccination campaign in Israel included individuals aged 12 years and upwards, but vaccination is 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 whether to vaccinate, to assist in the development of vaccination 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 had the vaccine themselves and since approval was granted for child vaccination.

**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, having symptomatic COVID-19, isolation, following COVID-19 instructions, vaccine acceptance); and (3) perceived health attitudes (e.g. knowledge, trust, doctor recommendations, neighbourhood norms, HBM construct, and influence of COVID-19). An online questionnaire was distributed between 27 and 30 April 2021 among 516 people aged 18 years or more and who lived in Israel. This took place after the FDA and Canadian authorities had approved vaccination for those aged 12 years and over, but before the Israeli health ministry had approved vaccination 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 a polling company. Respondents received a link to the online questionnaire and could choose whether to provide answers.

Questionnaire design

The questionnaire used in this study was based on various previous designs[18], [19], [20], [21], [22], [23], [24], [25], [26], [27] and included several sections. Section 1 included demographic data (age, gender, level of income, education, ethnic origin, and level of religiousness). Section 2 included questions regarding the effects of COVID-19 on respondents’ economic status, health status, mental status, and life 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 towards avoiding exposing children to crowded places and other people or having someone around you with COVID-19; the intention of themselves, their spouse, and their children to have the influenza vaccine; the intention for their children to have routine childhood vaccination; the intention for themself or their spouse to have the COVID-19 vaccination; the number of times their children were in isolation; and following government instructions. Section 4 included respondents’ perceptions of data concerning COVID-19: trust, knowledge, frequency of new updates, fear, doctor’s recommendations, fake news, neighbourhood norms, vaccine and child vaccine knowledge type, and the four constructs of the HBM (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 measurements is shown in Appendix A.

Statistical analyses

To analyse the data, a separate linear regression model was performed for each category of variable: (1) contextual influences; (2) health records, and (3) perceived health attitudes. Afterwards, combined linear regression was performed based on the significant variables identified during the previous stage. The dependent variables were the intention to vaccinate children at all ages (up to 16 years) and those aged 12–16, 6–12, and 0–6 years. This division of age groups is necessary because the vaccine is only approved for ages 12 to 16 years. Additionally, because there are differences in educational institutions, e.g. schools and kindergartens, which vary by class size, institution size, activities, and the ability to practice social distancing, the younger age group was separated into two groups, i.e. 0–6 and 6–12 years. Correlations between independent variables at each stage were checked to avoid multicollinearity issues.

**Results**

Table 1 describes the demographic variables for the sample (n=491) and for subsamples with children differentiated by age. The mean age of the sample was 38·2 years. In the full sample and in the subsample with children aged 0–6 years there were slightly more females than males, while in the other age groups the proportions were similar. More than 80% of the sample was secular or conservative. More than 45% of respondents in the full sample and in the subsample with children aged 0–6 years had an income lower than the average for Israel and about 35% in the other two subsamples had lower than average incomes. The percentage of respondents with higher degrees was about 21%.

[Insert Table 1 about here]

Table 1. Demographic data of the sample population with subsamples based on the age of respondents’ children.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable |  | Full sample, %  (n=491) | Age 12–16 years  (n=131) | Age 6–12 years  (n=220) | Age 0–6 years  (n=340) |
| Gender | Male | *46.3* | 50.4 | 48.6 | 44.4 |
| Female | *53.6* | 49.6 | 51.4 | 55.6 |
| Religiousness | Secular | *44.2* | 44.3 | 43.2 | 41.2 |
| Conservative | *38.1* | 38.2 | 41.4 | 37.9 |
| Orthodox | *15.5* | 17.6 | 13.6 | 17.9 |
| Strict orthodox | *2.2* | 0 | 1.8 | 2.9 |
| Income | Well above average | *5.3* | 3.8 | 5 | 5.3 |
| Above average | *20.2* | 26.7 | 26.4 | 18.8 |
| Average | *28.9* | 35.1 | 30.9 | 27.9 |
| Below average | *26.9* | 22.9 | 26.4 | 27.1 |
| Well below average | *18.7* | 11.5 | 11.4 | 20.9 |
| Education | High school | *19.9* | 15.3 | 15.9 | 27.5 |
| Professional diploma | *20.9* | 24.4 | 23.6 | 22.3 |
| Bachelor’s degree | 38.3 | 38.2 | 36.8 | 37.9 |
| Higher degree | 20.8 | 22.2 | 23.7 | 20.3 |

Considering COVID-19 vaccination, at the time of the survey 80% of respondents reported that both parents were vaccinated, 9·6% reported that one parent was vaccinated, and 10·4% reported that neither parent was vaccinated.

Table 2 shows the distribution of parents’ intention to vaccinate their children. The variable intention to vaccinate concerning the full sample represent the parent intention to vaccine children regardless of their children ages measured by the average intention over all the relevant child age groups (Alpha Cronbach 0·935). The intention to vaccinate children (regardless of age) was 3·49, which indicated that most parents viewed vaccination positively, but that some vaccine hesitancy existed. The intention to vaccinate decreased as the age of the children decreased. For parents with children aged 12–16 years, 66·4% of them population consider positively vaccine of their children. This decreased to 53·2% and 44·7% for those with children aged 6–12 and 0–6 years, respectively. On the other hand, 30·3% of parents with children aged 0–6 years negatively consider the vaccination. This percentage decreased to 15·9% and 7·6% for parents with children aged 6–12 and 12–16 years, respectively. The percentage of parents that were undecided was similar for parents of all age groups. In addition, there was a significant correlation between parents’ intention to vaccinate children in different age groups that belonged to the same family (Table 2).

[Insert Table 2 about here]

Table 2: Intention to vaccinate children: distribution and correlations

|  |
| --- |
|  |
| Intention to vaccinate children | Yes  [5] | Probably yes  [4] | Have not decided  [3] | Probably no  [2] | No  [1] | M  (SD) | Age12–16 years | Age 6–12 years | Age 0–6 years |
| Full sample  n=491 |  |  |  |  |  | 3.49  (1.29) |  |  |  |
| 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<0·01, \*\*\*p<0·001

Table 3 shows associations between contextual variables with the intention to vaccinate children. The results for the full sample and for parents of children aged 0–6 and 12–16 years indicated that men were significantly more likely compared with women to have their children vaccinated. The intention to vaccinate children in the full sample increased with age and in ages 0–6 years decreased with age. A higher level of education was associated with a decreased willingness to vaccinate children aged 12–16 years.

[Insert Table 3 about here]

Table 3. Associations between contextual variables with the intention to vaccinate children.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Full sample | | Age 12–16 years | | Age 6–12 years | | Age 0–6 years | |
| Variable | B | Std. Error | B | Std. Error | B | Std. Error | B | Std. Error |
| (Constant) | 3.29\* | 0.49 | 5.71\* | 0.92 | 3.60 | 0.80 | 4.37\*\*\* | 0.70 |
| Ethnic origin | 0.016 | 0.15 | 0.57 | 0.31 | -0.04 | 0.24 | -0.05 | 0.18 |
| Gender | -0.28\* | 0.12 | -0.45\* | 0.20 | -0.24 | 0.18 | -0.45\*\* | 0.16 |
| Age | 0.02\* | 0.01 | -0.01 | 0.02 | 0.01 | 0.01 | -0.03\* | 0.01 |
| Religiousness | 0.025 | 0.08 | 0.04 | 0.13 | 0.05 | 0.11 | -0.04 | 0.09 |
| Income | -0.09 | 0.06 | -0.10 | 0.10 | 0.01 | 0.09 | -0.07 | 0.07 |
| Education | 0.00 | 0.004 | -0.14\* | 0.07 | -0.04 | 0.06 | 0.07 | 0.05 |
|  | Adjusted *R*2 = 0.029;  p=.002 | | Adjusted *R*2 = 0.053;  p=.045 | | Adjusted *R*2 = -0.01;  p=.722 | | Adjusted *R*2 = 0.025;  p=.025 | |

Table 4 shows the association between parents’ health record and behaviour with their intention to vaccinate their children. The results indicated that parents who were themselves vaccinated against COVID-19 had a greater intention to vaccinate their children, in all samples. Those parents who have their children vaccinated against influenza were more likely to express an intention to vaccinate their child against COVID-19 (except for parents of children aged 6–12 years). The effects of the other variables were not found to influence the intention to vaccinate, except for family health status for parents of children aged 12–16 years and voluntary COVID-19 avoidance behaviour for parents of children aged 6–12 years.

[Insert Table 4 about here]

Table 4. Regression results for the health record and behaviour variables.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Full sample | | Age 12–16 years | | Age 6–12 years | | Age 0–6 years | |
| Variable | B | Std. Error | B | Std. Error | B | Std. Error | B | Std. Error |
| (Constant) | -13.15 | 10.05 | 14.75 | 18.26 | 33.39\* | 15.15 | -20.07 | 12.58 |
| Health status | 0.03 | 0.10 | 0.42\* | 0.19 | -0.04 | 0.15 | 0.00 | 0.13 |
| COVID-19 infection | 0.09 | 0.11 | 0.15 | 0.21 | -0.14 | 0.15 | 0.10 | 0.14 |
| Avoid | 0.16 | 0.10 | -0.12 | 0.19 | 0.37\* | 0.16 | 0.23 | 0.13 |
| Isolation | 0.02 | 0.04 | 0.02 | 0.08 | -0.02 | 0.06 | 0.05 | 0.06 |
| Influenza vaccine | 0.56\*\*\* | 0.13 | 0.53\* | 0.25 | 0.36 | 0.18 | 0.64\*\*\* | 0.16 |
| Follows instructions | 0.00 | .10 | 0.17 | 0.18 | -0.04 | 0.14 | -0.04 | 0.12 |
| Child vaccine | 0.32 | 0.28 | -1.31 | 1.1 | 0.14 | 0.42 | 0.30 | 0.32 |
| Parents COVID-19 vaccine | 1.26\*\*\* | 0.18 | 0.77\* | 0.36 | 1.05\*\*\* | 0.28 | 1.21\*\*\* | 0.22 |
|  | Adjusted *R*2 = 0.186;  p=.000 | | Adjusted *R*2 = 0.07;  p =.028 | | Adjusted *R*2 = 0.144;  p= .000 | | Adjusted *R*2 = 0.197;  p=.000 | |

\* p<0·05 \*\*p<0·01 \*\*\* p<0·001

Table 5 shows the associations between perceived health attitudes and parents’ intentions to have their children vaccinated against COVID-19. The results show that the intention to vaccinate children was higher among those who found the vaccine to have benefits. The intention to vaccinate increased for those who found the vaccine to have fewer limitations than not vaccinating, except for parents of children aged 6–12 years. Those who rank the information about the children vaccine as pro vaccine or do not see the virus as a difficult disease (severity) are more intend to vaccine their children in all the groups except for children ages 12 to 16.

[Insert Table 5 about here]

Table 5. Regression results for the perceived health attitudes variables.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Full sample | | Age 12–16 years | | Age 6–12 years | | Age 0–6 years | |
| Variable | B | Std. Error | B | Std. Error | B | Std. Error | B | Std. Error |
| (Constant) | 0.35 | 0.40 | 1.57 | 0.73 | 0.61 | 0.61 | 0.17 | 0.52 |
| Knowledge | 0.01 | 0.06 | -0.02 | 0.09 | 0.05 | 0.07 | 0.03 | 0.08 |
| Update frequency | -0.05 | 0.05 | -0.02 | 0.09 | -0.06 | 0.06 | -0.08 | 0.06 |
| Fake news | 0.04 | 0.04 | -0.01 | 0.07 | 0.01 | 0.07 | 0.06 | 0.06 |
| Trust | 0.16 | 0.09 | 0.26 | 0.15 | 0.20 | 0.12 | 0.14 | 0.11 |
| Doctor’s recommendation | 0.11 | 0.06 | -0.04 | 0.09 | 0.10 | 0.08 | 0.13 | 0.08 |
| Influence | 0.00 | 0.002 | 0.00 | 0.003 | 0.01 | 0.003 | 0.00 | 0.003 |
| Susceptibility | 0.00 | 0.04 | 0.02 | 0.07 | 0.00 | 0.05 | -0.03 | 0.05 |
| Severity | -0.18\* | 0.08 | 0.00 | 0.13 | -0.30\* | 0.12 | -0.27\*\* | 0.1 |
| Benefits | 0.85\*\*\* | 0.09 | 0.66\*\*\* | 0.17 | 0.65\*\*\* | 0.12 | 0.91\*\*\* | 0.11 |
| Barriers | -0.14\* | 0.58 | -0.20\* | 0.10 | -0.15 | 0.08 | -0.16\* | 0.08 |
| Fear | 0.00 | 0.05 | -0.14 | 0.10 | 0.10 | 0.07 | 0.08 | 0.07 |
| Neighbourhood norms | 0.05 | 0.07 | 0.18 | 0.13 | 0.11 | 0.11 | -0.04 | 0.09 |
| Vaccine knowledge type | -0.002 | 0.002 | -0.007 | 0.004 | -0.001 | 0.003 | -0.001 | 0.003 |
| Child vaccine knowledge type | 0.008\*\*\* | 0.002 | 0.007 | 0.003 | 0.01\*\*\* | 0.03 | 0.008\*\*\* | 0.003 |
|  | Adjusted *R*2 = 0.571;  p=.000 | | Adjusted *R*2 = 0.607;  p=.000 | | Adjusted *R*2 = 0.596;  p=.000 | | Adjusted *R*2 = 0.519;  p=.000 | |

\*p<0·05 \*\*p<0·01 \*\*\* p<0·001

The final model represented in Table 6 was based on a holistic approach that combined the different determinates into an extended model. Each of the significant variables from the previous stages was introduced into the extended model.

The final set of significant variables, regardless of their children’s age (full sample) included parents’ vaccine, severity, benefits, barriers, and child vaccine information type.

As the child’s age decreases, the number of significant determinates increases. For parents of all age groups, those who found the vaccine more beneficial had a greater intention to vaccinate their children. On the other hand, those parents who had more concerns about the vaccine’s side effects and effectiveness had less intention to vaccinate their children (except for parents of children aged 6–12 years). Parents who evaluate the information concerning child vaccine as more pro the campaign are more intend to vaccine their children for aged 12 and below. For parents of children aged 6–12 years, the set of significant variables also included avoiding visiting crowded places and severity. For parents of children aged 0–6 years, the set of significant variables also included parents’ vaccine and severity.

[Insert Table 6 about here]

Table 6. Final model of parents’ intention to have their children vaccinated against COVID-19.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Full sample | | Age 12–16 years | | Age 6–12 years | | Age 0–6 years | |
| Variable | B | Std. Error | B | Std. Error | B | Std. Error | B | Std. Error |
| (Constant) | 0.67\*\* | 0.28 | 1.73\*\*\* | 0.49 | -15.57\* | 7.3 | 0.47 | 0.35 |
| Avoid |  |  |  |  | 0.17\* | 0.08 |  |  |
| Parents vaccinated | 0.58\*\*\* | 0.13 |  |  |  |  | 0.56\*\*\* | 0.16 |
| Severity | -0.20\*\*\* | 0.06 |  |  | -0.31\*\* | 0.09 | -0.23\*\* | 0.08 |
| Benefits | 0.90\*\*\* | 0.07 | 0.83\*\*\* | 0.08 | 0.94\*\*\* | 0.09 | 0.94\*\*\* | 0.09 |
| Barriers | -0.17\*\* | 0.005 | -0.24\*\* | 0.08 |  |  | -0.16\* | 0.07 |
| Child vaccine knowledge type | 0.01\*\*\* | 0.002 |  |  | 0.01\*\*\* | 0.002 | 0.009\*\*\* | 0.002 |
|  | Adjusted *R*2 = 0.587;  p=.000 n=491 | | Adjusted *R*2 = 0.595;  p=.000 n=131 | | Adjusted *R*2 = 0.595;  p=.000; n=220 | | Adjusted *R*2 = 0.536;  p=.000; n=340 | |

\*p<0.05 \*\*p<0.01 \*\*\* p<0.001

**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 years or more. Recently, however, this trend has reversed, and most new cases are 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 [30]. The moral concern arises from the limited supply of vaccines, with WHO advising that wealthy countries should postpone their plan to immunise children and allow the rest of the world have access to the vaccines. There is some evidence of an inflammation of the hurt muscle for vaccinated people, which is higher than expected by the vaccine companies in young men. Other side effects are similar for children and adults.

The USA, 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 years. The USA has the largest proportion of children vaccinated, with 21·1% of children fully vaccinated by 29 June 2021.[31]

A potential barrier to childhood vaccine may be parents’ vaccine hesitancy, identified by WHO as a global health threat. Vaccine hesitancy can be dependent on the location (culture), time, and the specific vaccine [7]. Research into vaccine hesitancy covers aspects of behaviour, sociology, psychology, communication, and politics. current ,,may ’

The timing of a survey is critical when dealing with vaccine hesitancy, 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. This study was performed before the vaccine was approved in Israel for children but after the FDA and the European Union approved the COVID-19 vaccine for children 12. This research represents a holistic approach that combines previously identified factors found in the literature and distinguishes parents’ attitudes to vaccination of their children among three populations: children younger than school age (aged 0–6 years), children in elementary school (aged 6–12 years), and children in middle school (aged 12–16 years).

The acceptance of the COVID-19 vaccine among parents varied by their children’s age group: 44·7%, 53·2%, and 66·4% for children aged 0–6, 6–12, and 12–16 years, respectively. Previous studies that assessed vaccination acceptance rates showed extremely heterogeneous results: in China in September 2020 the rate was 72·6%, [26] in Australia in June 2020, 75·8%, [28] 60·4 in Italy in December 2020 and January 2021, [29] 64% in Canada in August 2020, [32] and 89·1% in the UK in April to May 2020. [23]

Our results indicate that between 25–31% of parents (depending on the age group of their children) had not yet made a decision whether to vaccinate, compared with 29·6% in Italy, [29] 17% in Canada, [32] and 16·7% in Australia. [28] 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 years, respectively. In Canada, 19·1% of parents negatively considered the vaccine, [32] in Australia this proportion was 7·6%, [28] and in Italy it was 9·9%.[29]

The results of our study indicate that different sets of variables affect parents’ willingness to vaccinate children according to the age of their children. Fathers were more likely to have their children vaccinated than mothers would, except for parents of children aged 6–12 years. Similar results were found in Italy.[29] These results are also in line with the higher level of vaccine hesitancy among women regarding self-vaccination. [33,34,24] Gender had a significant effect only when considering the demographic aspect. For the full sample, older respondents were more likely to vaccinate their children. This is in line with results reported for Italy, [29] China, [26] Australia, [28] and an international cross-sectional survey.[24] Those who had been vaccinated themselves were more likely to vaccinate their children. A similar result was found in Canada regarding the relationship between the intent of parents to have the vaccine themselves and to have their child vaccinated.[32] Parents who allow their children to have the influenza vaccine were more likely to vaccinate their children against COVID-19. This result is similar to results reported in Canada [32] and in an international cross-sectional survey.[24]

Those parents who considered the vaccine to be beneficial or have few limitations were more likely to vaccinate their children, which is similar to findings related to adult vaccination.[20],[19],[30] Parents that are more worried about the outcome of COVID-19 illness for their children are less likely to accept the vaccine for their children. This result is the opposite of previous findings regarding vaccination and it may reflect the risk utility calculation in the decision-making process. The severity may exceed the worries component and therefore decrease the intention to vaccine the children. Those who estimate the information as pro child vaccine are more intent to vaccine their children. This expend the results of Zhang who discussed the effect of COVID-19 vaccine information in social media. [26]

Considering all of the above factors together in one model yielded the finding that only specific COVID-19 illness and vaccine aspects significantly affected parents’ willingness to vaccinate their children. More specifically, the willingness to vaccinate their children was associated with parents’ own experiences with the COVID-19 vaccine, their pro-vaccination knowledge, benefits, barriers, and severity. There is no additional explanation effect for the demographic and the health record and behaviour factors above those concerning COVID-19. 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.[36]

Our results that differ from those of previous research may be due to the timing of our 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, and the number of new cases was 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 vaccines themselves may substitute the role of the demographic and the health behaviour record aspects.

Government and health institutions should continue the adult vaccination campaign alongside the child vaccination campaign, highlighting the benefits of the existing vaccine and the low level of barriers. The campaign to encourage child vaccination should mainly target parents who have been vaccinated themselves. Communicate the advantages and low level of risks in the child vaccine especially as a response for pro child vaccine information.

This study had some limitations. It was performed in just one country and involved a relatively small sample size. In particular, the number of parents with children aged 12–16 years and who were against the COVID-19 vaccine 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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**References**

[1] COVID-19 in Children and the Role of School Settings in Transmission—First Update. Available online: <https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-in-children-and-the-role-of-school-settings-in-transmission-first-update_1.pdf> Date accessed March 24, 2021).

[2] Bhopal, S.S.; Bagaria, J.; Olabi, B.; Bhopal, R. Children and Young People Remain at Low Risk of COVID-19 Mortality. Lancet Child

Adolesc. Health **2021**.

[3] Brookman, S.; Cook, J.; Zucherman, M.; Broughton, S.; Harman, K.; Gupta, A. Effect of the New SARS-CoV-2 Variant B.1.1.7 on

Children and Young People. Lancet Child Adolesc. Health **2021**, 5, e9–e10.

[4] Israel Ministry of Health. COVID-19 daily situation report. https:// datadashboard.health.gov.il/COVID-19/general (accessed June 6, 2021; in Hebrew). [4.5] (<https://ourworldindata.org/covid-vaccinations?country=~ISR>, accessed June 6, 2021).

[5] Haas JE, Angulo FJ, McLaughlin JM, et al. Impact and effectiveness of mRNA BNT162b2 vaccine against SARS-CoV-2 infections and COVID-19 cases, hospitalisations, and deaths following a nationwide vaccination campaign in Israel: an observational study using national surveillance data. *Lancet* 2021; published online May 5. https://doi.org/10.1016/ S0140-6736(21)00947-8.

[6] Leshem, E., & Wilder-Smith, A. (2021). COVID-19 vaccine impact in Israel and a way out of the pandemic. *The Lancet*, *397*(10287), 1783-1785.

[7] MacDonald NE and SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. Vaccine 2015;33:4161–4.

[8] Karafllakis E, Larson HJ, and ADVANCE Consortium. The benefit of the doubt or doubts over benefits? a systematic literature review of perceived risks of vaccines in European populations. Vaccine 2017;35:4840–50.

[9] Cobos Muñoz D, Monzón Llamas L, Bosch-Capblanch X. Exposing concerns about vaccination in low- and middle-income countries: a systematic review. Int J Public Health 2015;60:767–80.

[10] Milman, O., Yelin, I., Aharony, N., Katz, R., Herzel, E., Ben-Tov, A., ... & Kishony, R. (2021). SARS-CoV-2 infection risk among unvaccinated is negatively associated with community-level vaccination rates. *MedRxiv*.

[11] Salo, J., Hagg, M., Kortelainen, M., Leino, T., Saxell, T., Siikanen, M., & Saaksvuori, L. (2021). The indirect effect of mRNA-based Covid-19 vaccination on unvaccinated household members. *medRxiv*.

[12] Zimet, G.D.; Silverman, R.D.; Fortenberry, J.D. Coronavirus Disease 2019 and Vaccination of Children and Adolescents: Pro‐ spects and Challenges. J. Pediatr. 2021, 231, 254–258, doi:10.1016/j.jpeds.2020.11.002.

[13] Klass, P.; Ratner, A.J. Vaccinating Children against Covid‐19—The Lessons of Measles. N. Engl. J. Med. 2021, 384, 589–591, doi:10.1056/nejmp2034765.

[14] Principi, N.; Esposito, S. Why It Is Important to Develop an Effective and Safe Pediatric COVID‐19 Vaccine. Vaccines 2021, 9, 127, doi:10.3390/vaccines9020127

[15] Randolph, H.E.; Barreiro, L.B. Herd Immunity: Understanding COVID-19. *Immunity* **2020**, *52*, 737–741.

[16] Velavan, T. P., Pollard, A. J., & Kremsner, P. G. (2020). Herd immunity and vaccination of children for COVID-19. *International Journal of Infectious Diseases*, *98*, 14-15.‏

[17] García-Montero, C., Fraile-Martínez, O., Bravo, C., Torres-Carranza, D., Sanchez-Trujillo, L., Gómez-Lahoz, A. M., ... & Bujan, J. (2021). An Updated Review of SARS-CoV-2 Vaccines and the Importance of Effective Vaccination Programs in Pandemic Times. Vaccines 2021, 9, 433.

[18] Teitler-Regev S, Shahrabani S, Benzion U. Factors affecting intention among students to be vaccinated against A/H1N1 influenza: a health belief model approach. Adv Prev Med 2011; 353207.‏

[19] Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: how many people would get vaccinated? Vaccine 2020;38(42):6500–7.‏

[20] Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. Hum Vaccin Immunother 2020;16(9):2204–14.‏

[21] Barakat AM, and Kasemy ZA. Preventive health behaviours during coronavirus disease 2019 pandemic based on health belief model among Egyptians. Middle East Curr Psychiatry 2020;27(1):1–9.‏

[22] Jose R, Narendran M, Bindu A, Beevi N, Manju L, Benny PV. Public perception and preparedness for the pandemic COVID 19: a health belief model approach. Clin Epidemiol Publ Health10 July2020. <https://doi.org/10.1016/j.cegh.2020.06.009>.

[23] Bell, S., Clarke, R., Mounier-Jack, S., Walker, J. L., & Paterson, P. (2020). Parents’ and guardians’ views on the acceptability of a future COVID-19 vaccine: A multi-methods study in England. *Vaccine*, *38*(49), 7789-7798.‏

[24] Goldman, R. D., Yan, T. D., Seiler, M., Cotanda, C. P., Brown, J. C., Klein, E. J., ... & Staubli, G. (2020). Caregiver willingness to vaccinate their children against COVID-19: Cross sectional survey. *Vaccine*, *38*(48), 7668-7673.

‏[25] Helmkamp, L. J., Szilagyi, P. G., Zimet, G., Saville, A. W., Gurfinkel, D., Albertin, C., ... & Kempe, A. (2021). A validated modification of the vaccine hesitancy scale for childhood, influenza and HPV vaccines. *Vaccine*, *39*(13), 1831-1839.‏

[26] Zhang, K. C., Fang, Y., Cao, H., Chen, H., Hu, T., Chen, Y. Q., ... & Wang, Z. (2020). Parental acceptability of COVID-19 vaccination for children under the age of 18 years: cross-sectional online survey. *JMIR pediatrics and parenting*, *3*(2), e24827.‏

[27] Costa MF. Health belief model for coronavirus infection risk determinants. Revista de Saúde Pública 2020;54:47.‏

[28] Rhodes, A.; Hoq, M.; Measey, M.-A.; Danchin, M. Intention to Vaccinate against COVID-19 in Australia. Lancet Infect. Dis. 2020.

[29] Montalti, M., Rallo, F., Guaraldi, F., Bartoli, L., Po, G., Stillo, M., ... & Gori, D. (2021). Would Parents Get Their Children Vaccinated Against SARS-CoV-2? Rate and Predictors of Vaccine Hesitancy According to a Survey over 5000 Families from Bologna, Italy. *Vaccines*, *9*(4), 366.

[30] Bhopal, S. S., Bagaria, J., Olabi, B., & Bhopal, R. (2021). Children and young people remain at low risk of COVID-19 mortality. *The Lancet Child & Adolescent Health*, *5*(5), e12-e13.‏

[31] CDC <https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends>

[32] Drouin, O., Montmarquette, C., Prud'homme, A., Arnaud, Y., Fontaine, P., & Borgès Da Silva, R. (2021). Parental decision and intent towards COVID-19 vaccination in children with asthma. An econometric analysis. *An Econometric Analysis (March 1, 2021)*.

[33] Neumann-Böhme S, Varghese NE, Sabat I, et al. Once we have it, will we use it? a European survey on willingness to be vaccinated against COVID-19. Eur J Health Econ 2020;21(7): 977–82.‏

[34] Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. Hum Vaccin Immunother 2020;16(9):2204–14.‏

[35] Dror AA, Eisenbach N, Taiber S, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. Eur J Epidemiol 2020 ; 35(8):775–9.

[36] Teiter Regev S., Hon Snir S COVID-19 vaccine hesitancy in Israel immediately before the vaccine operation,submitted for publication

**Appendix**

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| --- | --- | --- |
| 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 by 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 = Strict orthodox | Level of religiousness |
| Ethnic origin | 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 following government instructions for COVID-19, 1 to 5 |
| COVID-19 illness | 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 years in isolation? |
| How many times were your children aged 6 to 12 years 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? |
| Knowledge | 5 = Very much  1 = Very little | How much do you know about COVID-19? 1 to 5 |
| Update frequency | 4 = Several times in a day  3 = Daily  2= Weekly  1 = I don’t update | How often do you read or hear news about COVID-19? 1 to 4 |
| Fake news | 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 for 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 kids 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 security 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 scary. |
| I am worried that my children will get COVID-19. |
| Neighbourhood norms  Cronbach alpha = 0.815 | 5 = Very much agree  1 = Do not agree at all | People around me plan to vaccinate their children. |
| People that are important to me are pro child vaccination. |
| I will have family support if I decide to vaccinate my child. |
|  |  |  |
| Influence  Cronbach alpha = 0.0.735 | 1 = No influence 100 = High influence | Rate the effect of COVID-19 on your life (1 to 100). |
| Rate the effect of COVID-19 on your economic situation (1 to 100). |
| Rate the effect of COVID-19 on your medical situation (1 to 100). |
| Rate the effect of COVID-19 on your mental situation (1 to 100). |
| Doctor  0.865 | 5 = Very much agree  1 = Do not agree at all | Recommendation from the pediatrician is reliable and can be trusted. |
| I will vaccinate my child if I receive a recommendation from the pediatrician. |
| Vaccine knowledge type | 1= against vaccine  100= pro vaccine | How would you rate the information regarding the COVID-19 vaccine? |
| Child vaccine knowledge type | 1= against vaccine  100= pro vaccine | How would you rate the information regarding the COVID-19 vaccine for children? |