

Original Article
Preventive & Social Medicine



Pediatric and Parents' Attitudes Towards COVID-19 Vaccines and Intention to Vaccinate for Children

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OPEN ACCESS

Received: Jun 17, 2021

Accepted: Jul 29, 2021

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Funding

This work was supported by clinical research grant from Pusan National University Hospital in 2021 and 2021 research grant from Pusan National University Yangsan Hospital.

Disclosure

The authors have no potential conflicts of interest to disclose.

ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) vaccination is necessary to reach herd immunity and essential for mitigating the spread of the pandemic. In May 2021, the US FDA and the EU have expanded the emergency use authorization for a COVID-19 vaccine to children aged 12 to 15. The aim of this study was to investigate parental acceptability of COVID-19 vaccination for their children, factors affecting their acceptability, and children's perceptions of COVID-19 vaccines in Republic of Korea.

Methods: We conducted a questionnaire survey at two tertiary hospitals from May 25, 2021 to June 3, 2021. Subjects were parents having children under 18 years and children aged 10–18 years.

Results: Two hundred twenty-six parents and 117 children aged 10–18 years were included in the final analysis. Overall, 76.5% and 64.2% of parents intended to get vaccinated against COVID-19 and intended to have their children vaccinated, respectively. However, only 49.6% of children responded that they would get COVID-19 vaccination. In the multivariate analysis, high confidence in the safety of COVID-19 vaccines (adjusted odds ratio [AOR], 4.87; 95% confidence interval [CI], 1.32–24.12), parents' willingness to vaccinate themselves (AOR, 19.42; 95% CI, 6.85–64.00), and awareness of the need to vaccinate children against COVID-19 (AOR, 13.15; 95% CI, 4.77–41.27) were associated with positive factors intention to vaccinate their children.

Conclusion: This study provides insight into how parents think about the COVID-19 vaccine for their children in South Korea. Our findings could be referenced in establishing a policy for childhood COVID-19 vaccination in the future.

Keywords: COVID-19 Vaccines; Vaccination Refusal; Parents; Child; Adolescent

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic is ongoing. As of June 12, 2021, there have been 174,918,667 confirmed cases of COVID-19, including 3,782,490 deaths globally.¹ The long-term success of the public health response to COVID-19 would depend on herd immunity.² To establish herd immunity, the immunity generated by natural infection or vaccination must prevent onward transmission, not just clinical disease. The estimated herd

Author Contributions

Conceptualization: Park SE. Data curation: Jo YH, Jo KJ, Choi SH. Formal analysis: Choi SH. Funding acquisition: Choi SH, Park SE. Investigation: Jo YH, Jo KJ. Methodology: Choi SH, Park SE. Software: Choi SH. Validation: Choi SH, Jo KJ. Visualization: Choi SH. Writing - original draft: Choi SH. Writing - review & editing: Choi SH, Park SE.

immunity threshold was noted approximately 67% for COVID-19.² However, several studies have shown that achieving herd immunity through natural infection might be difficult.³⁻⁵ Vaccination is necessary to reach herd immunity threshold for COVID-19.

As of June, 11, 2021, six vaccines were listed on the WHO's Emergency Use List and approved for use: BNT162b2, mRNA-1273, AZD1222, Ad26.COVS.2, BIBP/Sinopharm, and CoronaVac.^{6,7} Among these vaccines, BNT162b2 was approved for individuals aged 16 years and older.⁷ On May, 10, 2021, the US FDA expanded the emergency use authorization for BNT162b2 vaccine to include adolescents 12 to 15 years of age.⁸ On May 28, 2021, BNT162b2 vaccine was approved for use in children aged 12 to 15 in the EU.⁹ Since mass vaccination was launched in South Korea on February 26, 2021, 23.0% of the nation's population have received at least one dose of COVID-19 vaccine as of June, 12, 2021.¹⁰ In South Korea, COVID-19 vaccination for children (under the age of 18 years) has not yet been approved. It is likely to expand to this age group.¹¹

The aim of this study was to investigate parental acceptability of COVID-19 vaccination for their children and factors affecting their acceptability. In addition, we evaluated perceptions of children (aged 10 to 18 years) regarding childhood COVID-19 vaccination.

METHODS**Study design and data collection**

We conducted a questionnaire survey to investigate adolescents and parents' perceptions of COVID-19 vaccination for children and adolescents. The survey recruitment took place at the Pediatrics Outpatient Clinics of Pusan National University Hospital (Busan, Republic of Korea) and Pusan National University Children's Hospital (Yongsan, Republic of Korea) from May 25, 2021 to June 3, 2021. Subjects were parents having children under the age of 18 years and children or adolescents aged 10–18 years, who agreed to participate in the survey.

The questionnaire for parents had six sections (**Supplementary Data 1**): sociodemographic characteristics, family members and medical history, COVID-19 related history, attitudes toward COVID-19, attitudes toward COVID-19 vaccines, and acceptance of COVID-19 vaccination for their children. For children or adolescents, the questionnaire had four sections (**Supplementary Data 2**): age and gender, COVID-19 related history, attitudes toward COVID-19, and acceptance of COVID-19 vaccines. Responses to “attitudes” or “acceptance” were rated as follows: extremely likely, somewhat likely, neither likely nor unlikely, somewhat unlikely, and extremely unlikely.

The main outcome of the study was parents' willingness to vaccinate their children with COVID-19 vaccine. Predictor variables such as concerns about COVID-19, retrieval of COVID-19 vaccine information, trust in COVID-19 vaccine information, and confidence of effectiveness or safety of COVID-19 vaccines were analyzed.

Statistical analysis

Categorical variables were presented as counts and percentage. They were compared using Fisher's exact test. For parents' willingness to vaccinate their children, univariate analysis was performed to compare acceptance (responses of “extremely likely” or “somewhat likely”) and non-acceptance (responses of “neither likely nor unlikely,” “somewhat unlikely,” or “extremely unlikely”) groups of parents. A multiple logistic regression was performed to

determine factors affecting parental intention to vaccinate their children using variables with $P < 0.1$ in the univariate analysis. Statistical significance was considered when a two-sided P value was less than 0.05. All statistical analyses were performed using Prism 9 (GraphPad Software Inc., San Diego, CA, USA).

Ethics statement

The study protocol was reviewed and approved by the Institutional Review Board of Pusan National University Hospital (approval No. 2105-017-103) and Pusan National University Children's Hospital (approval No.05-2021-098). Informed consent was obtained from all subjects when they were enrolled.

RESULTS

Two hundred twenty-six parents and 117 children aged 10–18 years were included in the final analysis. Baseline characteristics of these participants are presented in **Table 1**. Most (79.6%) of parent participants were mothers. The age group having the most participants was 40–49 years. Among children of parent participants, 47.1% were 7–12 years old. About half (48.7%, 167/343) of total participants had been tested for COVID-19 by themselves or someone in their family. Among parent participants, 118 (52.2%) had household members having underlying diseases or belonging to risk groups and 77 (34.1%) had children who had underlying diseases (**Table 2**).

Participants' attitudes toward COVID-19 are shown in **Fig. 1**. More than 90% of participants expressed “serious disease” or “anxiety about SARS-CoV-2 infection.” Anxiety of vulnerability to COVID-19 in children was higher in parent participants than in child/adolescent participants (69.5% vs. 52.1%, $P = 0.002$).

Awareness of COVID-19 vaccines in participants is summarized in **Table 3**. The proportion of respondents who actively searched for COVID-19 vaccine information was significantly higher in parent participants than in child/adolescent participants (54.9% vs. 17.9%, $P < 0.001$). Regarding the effectiveness and safety of COVID-19 vaccines, 51.3% (176/343) responded with “preventive,” while only 27.7% (95/343) responded with “safe.” Among parent participants, 179 (79.2%) responded that children and adolescents needed COVID-19 vaccination. If COVID-19 vaccination is available for children under 18 years old, 58.8% of parent participants selected ‘16–18 years’ as the prior age group for vaccination (**Fig. 2**). Overall, 76.5% of parents intended to get vaccinated against COVID-19 and 64.2% intended to let their children get vaccinated. The agreement rate of intention to vaccinate themselves and their children was the highest in “neither likely nor unlikely” (**Fig. 3**). One hundred thirty-seven parent participants were divided into three groups of < 7 years (45/137), 7–12 years (63/137), and 13–18 years (29/137) according to their children's age subgroups. Among these, there was no significant difference in parents' willingness to vaccinate their children by children's age subgroups (55.5% in < 7 years; 63.5% in 7–12 years; 62.1% in 13–18 years; $P = 0.695$). In child/adolescent participants, 49.6% responded they would get COVID-19 vaccination (**Fig. 4**). There was no significant difference in acceptance rate by age subgroups (50.9% in 10–12 years; 50.0% in 13–15 years; 44.4% in 16–18 years; $P = 0.890$).

Between parents who were willing to vaccinate their children and those who were not, there were no statistical differences in age of parents, level of education, family income, or

Table 1. Baseline characteristics of participants

Characteristics	Values
Parents (n = 226)	
Parents	
Father	46 (20.4)
Mother	180 (79.6)
Age of the parent, yr	
≤ 29	1 (0.4)
30–39	77 (34.1)
40–49	136 (60.2)
≥ 50	11 (4.9)
Level of education	
Middle school or below	1 (0.4)
High school or equivalent	46 (20.4)
College or university	129 (57.1)
Graduate school or above	50 (22.1)
Monthly family income (10,000 Won)	
< 300	38 (16.8)
300–400	51 (22.6)
400–500	53 (23.5)
> 500	84 (37.2)
No. of household members	
≤ 3	61 (27.0)
4	130 (57.5)
5	29 (12.8)
≥ 6	6 (2.7)
No. of children	
1	58 (25.7)
2	135 (59.7)
3	28 (12.4)
≥ 4	5 (2.2)
Age distribution of children (n = 437), yr	
< 1	14 (3.2)
1–3	38 (8.7)
4–6	55 (12.6)
7–12	206 (47.1)
13–15	76 (17.4)
16–18	28 (6.4)
≥ 19	20 (4.6)
History associated with COVID-19 in household members	
COVID-19 confirmed	2 (0.9)
Self-quarantine	20 (8.8)
Tested for COVID-19	112 (49.6)
Child/adolescent (n = 117)	
Gender	
Boys	47 (40.2)
Girls	70 (59.8)
Year of birth (age)	
2003–2005 (16–18 yr)	18 (15.4)
2006–2008 (13–15 yr)	46 (39.3)
2009–2011 (10–12 yr)	53 (45.3)
History associated with COVID-19 in household members	
COVID-19 confirmed	1 (0.9)
Self-quarantine	11 (9.4)
Tested for COVID-19	55 (47.0)

Values are presented as number (%).
 COVID-19 = coronavirus disease 2019.

Table 2. Underlying diseases or risk groups in family

Characteristics	Values (n = 226)
Underlying diseases or risk groups in household members ^a	
Malignancy	11 (4.9)
Cerebrovascular diseases	5 (2.2)
Neurologic diseases	1 (0.4)
Cardiovascular diseases	9 (4.0)
Chronic pulmonary diseases	1 (0.4)
Chronic renal diseases	2 (0.9)
Chronic liver diseases	2 (0.9)
Hematopoietic stem cell or solid organs transplantation	1 (0.4)
Hypertension	35 (15.5)
Diabetes mellitus	15 (6.6)
Extreme obesity	8 (3.5)
Smoker	51 (22.6)
Age ≥ 65 yr	10 (4.4)
Pregnancy	0 (0.0)
Healthcare worker	22 (9.7)
Underlying diseases in children	
Prematurity	37 (16.4)
Heart diseases	6 (2.7)
Pulmonary diseases	8 (3.5)
Hepatobiliary/gastrointestinal diseases	4 (1.8)
Neurologic diseases	10 (4.4)
Endocrine diseases	11 (4.9)
Renal diseases	4 (1.8)
Malignancy	15 (6.6)
Genetic disorders	2 (0.9)

Values are presented as number (%).

^aExcluding their children.

Table 3. Awareness of COVID-19 vaccines in participants

Variables	Parent (n = 226)	Child/adolescent (n = 117)	P value
Attention for COVID-19 vaccines			
Active acquisition of information ^a	124 (54.9)	21 (17.9)	< 0.001
0 times a wk	6 (2.7)	26 (22.2)	
1-2 times a wk	95 (42.0)	47 (40.2)	
3-4 times a wk	63 (27.9)	23 (19.7)	
5-6 times a wk	39 (17.3)	12 (10.3)	
≥ 7 times a wk	23 (10.2)	7 (6.0)	
Level of trust in information ^a	79 (35.0)	32 (27.4)	0.181
Confidence in COVID-19 vaccines ^a			
Preventive	117 (51.8)	59 (50.4)	0.821
Safe	66 (29.2)	29 (24.8)	0.446
Acceptance of COVID-19 vaccination ^a			
Parents themselves	173 (76.5)	NA	NA
Children/adolescents	145 (64.2)	58 (49.6)	0.018

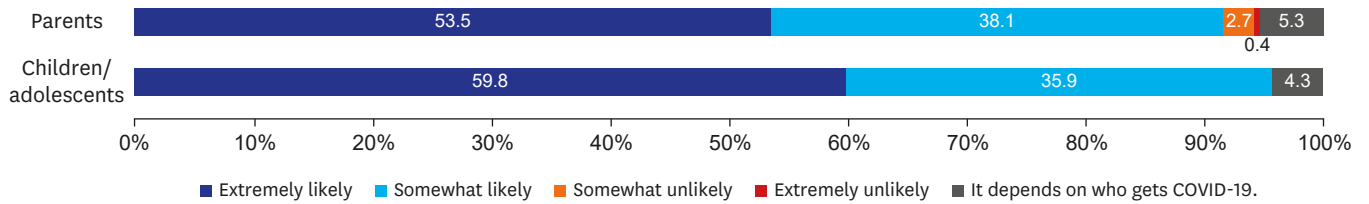
Values are presented as number (%).

COVID-19 = coronavirus disease 2019, NA = non-applicable.

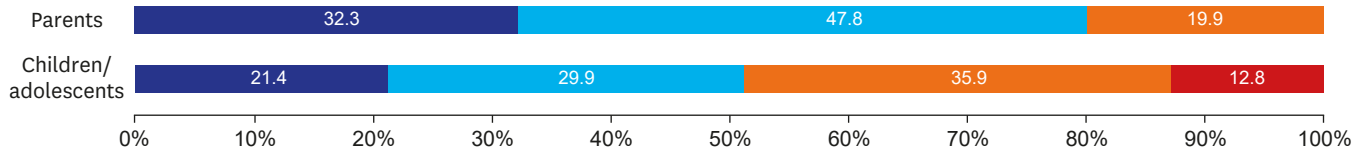
^aAnswer 'extremely likely' or 'likely' in the questionnaire.

Perception of COVID-19 Vaccination for Children

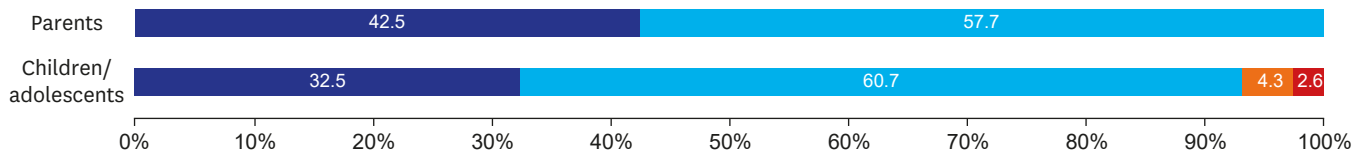
A I think the COVID-19 is a serious disease.



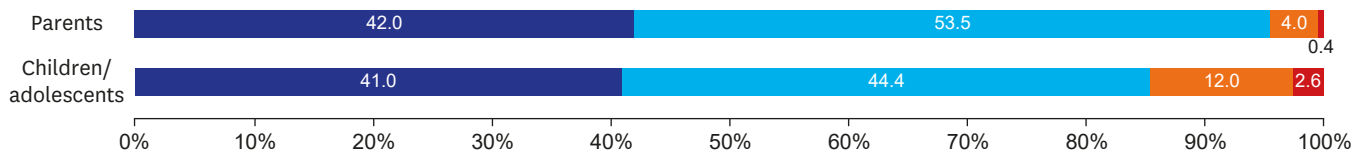
B There are members in my family who can become severe if they get COVID-19.



C My family or I could get COVID-19.



D I'm worried that I or someone in my family might get COVID-19.



E [Parent] My child/children is/are vulnerable to COVID-19. / [Children/adolescents] I could easily get COVID-19.

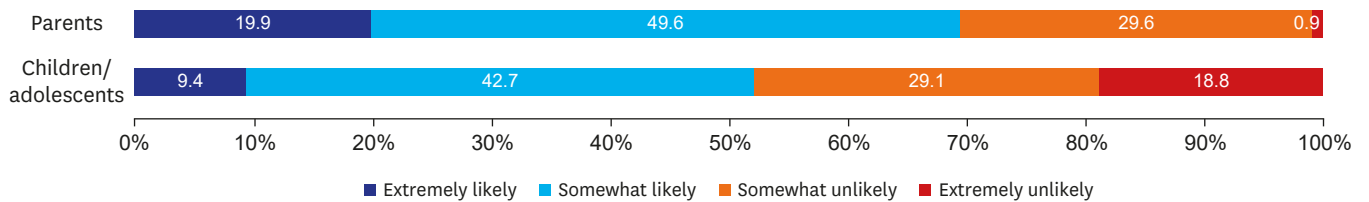
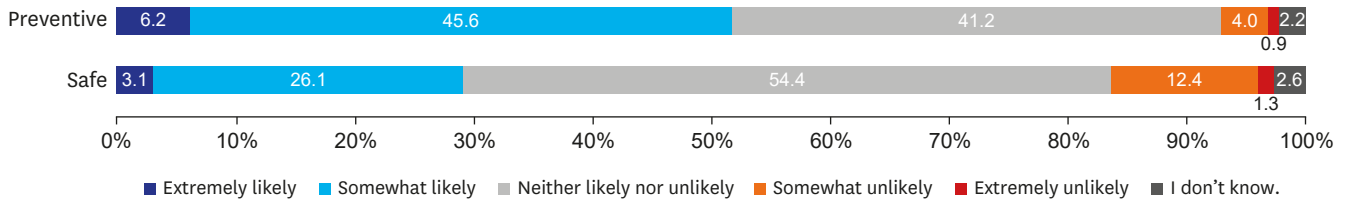


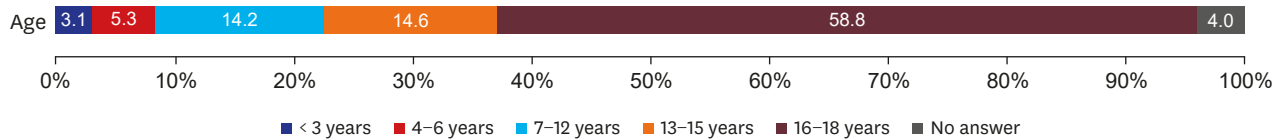
Fig. 1. Participants' perception of COVID-19. COVID-19 = coronavirus disease 2019.

Perception of COVID-19 Vaccination for Children

A How likely would you think the COVID-19 vaccines are preventive/safe?



B If a vaccine against COVID-19 was available for children, who do you think should be vaccinated first?



C If a vaccine against COVID-19 was available, how likely would you be to get vaccinated/get your children vaccinated?

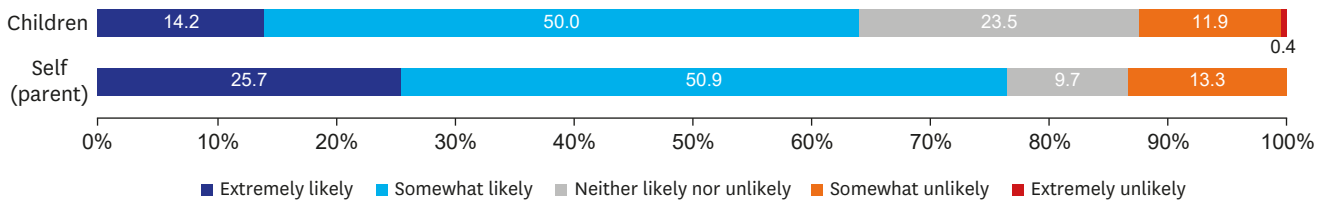


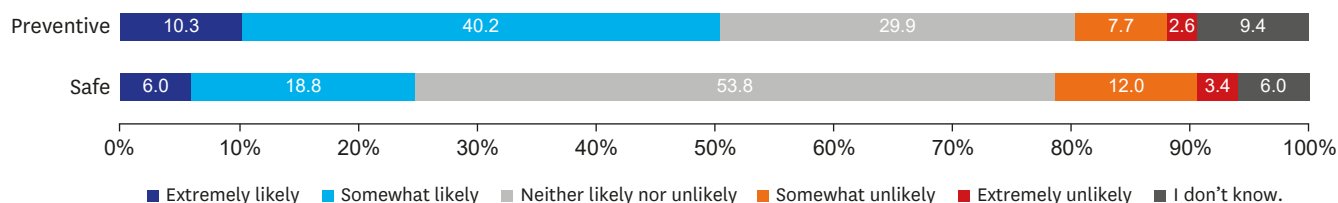
Fig. 2. Parental awareness and potential acceptability of COVID-19 vaccination for their children. **(A)** Confidence in the effectiveness and safety of COVID-19 vaccines. **(B)** The prior age group of COVID-19 vaccination for children. **(C)** Intention to vaccinate themselves and their children. COVID-19 = coronavirus disease 2019.

			Parents' willingness to vaccinate their children (%)				
Parents' willingness to vaccinate themselves	No. of respondents (%)	Answer	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Extremely unlikely
		58 (25.7)	Extremely likely	27 (46.6)	26 (44.8)	3 (5.2)	1 (1.7)
	115 (50.9)	Somewhat likely	5 (4.3)	80 (69.6)	23 (20.0)	7 (6.1)	0 (0.0)
	23 (9.7)	Neither likely nor unlikely	0 (0.0)	3 (13.0)	19 (82.6)	1 (4.3)	0 (0.0)
	30 (13.3)	Somewhat unlikely	0 (0.0)	4 (13.3)	8 (26.7)	18 (60.0)	0 (0.0)
	0 (0.0)	Extremely unlikely	NA	NA	NA	NA	NA
Total	226 (100.0)		32 (14.2)	113 (50.0)	53 (23.5)	27 (11.9)	1 (0.4)

Fig. 3. The agreement rate of intention to vaccinate parents themselves and their children. NA = non-available.

Perception of COVID-19 Vaccination for Children

A How likely would you think the COVID-19 vaccines are preventive/safe?



B If a vaccine against COVID-19 was available, how likely would you be to get vaccinated?

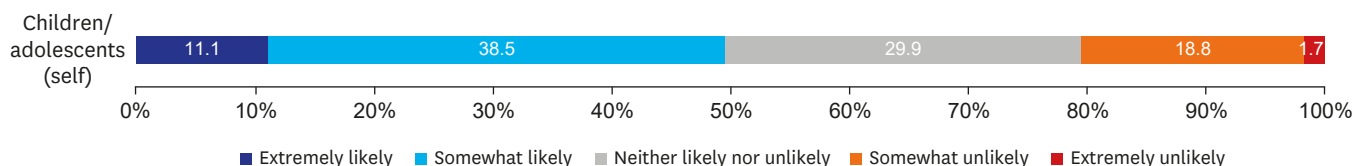


Fig. 4. Children and adolescents' awareness and potential acceptability of COVID-19 vaccination. **(A)** Confidence in the effectiveness and safety of COVID-19 vaccines. **(B)** Intention to get COVID-19 vaccination. COVID-19 = coronavirus disease 2019.

Table 4. Factors of parents' intention to vaccinate their children

Variables	Acceptance (n = 145)	Non-acceptance (n = 81)	Univariate analysis		Multivariate analysis	
			OR (95% CI)	P value	OR (95% CI)	P value
Underlying diseases or risk groups in household members	73 (50.3)	45 (55.6)	0.81 (0.50–1.40)	0.489	-	-
Underlying diseases in their children	50 (34.5)	27 (33.3)	1.05 (0.83–1.25)	0.885	-	-
Concerns about family health in case of COVID-19	118 (81.4)	63 (77.8)	1.25 (0.64–2.44)	0.603	-	-
Concerns about their children vulnerability to COVID-19	94 (64.8)	63 (77.8)	0.53 (0.28–0.98)	0.050	0.49 (0.19–1.19)	0.124
History of tested for COVID-19 in family	64 (41.6)	48 (59.3)	0.54 (0.31–0.94)	0.037	0.26 (0.10–0.63)	0.004
Active acquisition of COVID-19 vaccine information	94 (64.8)	30 (37.0)	3.13 (1.78–5.52)	< 0.001	1.54 (0.65–3.67)	0.328
Trust in COVID-19 vaccines information	59 (40.7)	20 (24.7)	2.09 (1.14–3.83)	0.020	0.77 (0.29–1.99)	0.597
Confidence in effectiveness of COVID-19 vaccines	94 (64.8)	23 (28.4)	4.65 (2.57–8.40)	< 0.001	1.46 (0.56–3.81)	0.440
Confidence in safety of COVID-19 vaccines	63 (43.4)	3 (3.7)	19.98 (6.02–66.27)	< 0.001	4.87 (1.32–24.12)	0.028
Parents' willingness to vaccinate themselves against COVID-19	138 (95.2)	35 (43.2)	25.91 (10.77–62.32)	< 0.001	19.42 (6.85–64.00)	< 0.001
Awareness of the need to vaccinate children against COVID-19	136 (93.8)	43 (53.1)	13.35 (5.98–29.83)	< 0.001	13.15 (4.77–41.27)	< 0.001

Values are presented as number (%).

OR = odds ratio, CI = confidential interval, COVID-19 = coronavirus disease 2019.

numbers of their children. In the multivariate analysis, high confidence of COVID-19 vaccines safety (adjusted odds ratio [AOR], 4.87; 95% confidential interval [CI], 1.32–24.12), parents' willingness to vaccinate themselves (AOR, 19.42; 95% CI, 6.85–64.00), and awareness of the need for children's COVID-19 vaccination (AOR, 13.15; 95% CI, 4.77–41.27) were associated with determining factors intention to vaccinate their children (Table 4). However, history of tested for COVID-19 in themselves or family members was a negative factor associated with the intention to vaccinate their children (AOR, 0.26; 95% CI, 0.10–0.63).

DISCUSSION

This study determined the potential acceptance of COVID-19 vaccination for children in 226 parents and 117 children/adolescents using a questionnaire survey. Overall, 59.2% (64.2% of parents and 49.6% of children/adolescents) responded with “acceptable” regarding COVID-19 vaccination for children. There was a statistically significant difference in the intention to have COVID-19 vaccination for children between children/adolescents and parents ($P = 0.018$). Our study showed that parents' willingness to vaccinate themselves was the most

significant factor in accepting COVID-19 vaccination for their children (AOR, 19.42; 95% CI, 6.85–64.0). In addition, high confidence in the safety of COVID-19 vaccines and the necessity of vaccinating children were significantly associated with the intention to vaccinate their children. To the best of our knowledge, survey regarding acceptance and attitudes towards children and adolescents' COVID-19 vaccination in South Korea has not been reported yet.

According to a recent survey on 1,000 adults over age 18 years that was performed from April 27 to April 29, 2021, commissioned by Korean government, 61.4% of 943 unvaccinated respondents said they were willing to be vaccinated.¹² The main reason for vaccination was COVID-19 prevention for the family (80.8%) and the main reason for hesitancy was concern about adverse events after vaccination (84.1%). These respondents obtained COVID-19 vaccines-related information through media reports (79.1%) or government announcement (66.8%). The majority (69.4%) responded that harmful effects of vaccines-related false information were serious. A recent report regarding global attitudes towards a COVID-19 vaccines showed that concerns about side effects and insufficient testing of vaccines were main barriers to vaccine uptake.¹³ Of respondents from different countries included in that report, trust in vaccines (47%) and confidence in health authorities (42%) were the lowest in Korean respondents as of mid-May of 2021. Results of our study were consistent with those of these surveys. Based on parents' responses, trust in COVID-19 vaccines-related information was low (35.0%), and 70% of parents had concerns about vaccine safety. However, acceptance of COVID-19 vaccination for themselves was higher (76.5%) than in the recent government survey.¹²

In an online survey research performed in July 2020, COVID-19 vaccine refusal rate was predicted to be 29.4% in the French working-age population.¹⁴ COVID-19 vaccine refusal and hesitancy were significantly associated with female gender, age with an inverted U-shaped relationship, lower educational level, poor compliance with recommended vaccinations in the past, and no report of specified chronic conditions.¹⁴ El-Elimat et al.¹⁵ conducted a study in November 2020 and reported that the public acceptability of COVID-19 vaccines was 37.4% in Jordan. Participants who believed that vaccines are generally safe were more likely to accept COVID-19 vaccines (AOR, 9.258; 95% CI, 6.020–14.237).

There are a few studies regarding COVID-vaccine hesitancy or resistance among parents.¹⁶⁻²⁴ Results of reported studies were similar to those of the present study. Among parents surveyed in the US, 40-60% planned to get their children vaccinated.²⁵ Main reasons for not vaccinating were as followings: “not sure it will be safe (59%),” “vaccine developed too quickly (59%),” and “don't trust information being published about the vaccine (48%).” Parents reported similar or slightly lower intent to vaccinate their children compared to intent to vaccinate themselves. A survey of 971 members of a national parents organization conducted between March 7 and March 12, 2021 showed that while 70% of parents planned to get or have already received the vaccine, only 58% of parents said they would probably or definitely vaccinate their children.²³ Parents' willingness to vaccinate their children closely matched their willingness to get vaccinated themselves.²¹ A Turkish study conducted in February 2021 showed that 36.3% and 59.9% of parents were willing to vaccinate their children and themselves, respectively.²⁶ Parents' willingness (AOR, 24.8; 95% CI, 10.9–56.6) and positive attitudes towards COVID-19 vaccine were factors that increased the acceptance of COVID-19 vaccine for their children. In a German study using data collected in May 2020, 58% of parents intended to get COVID-19 vaccination and 51% intended to have their children vaccinated.²⁰ Significant predictors for the intention to vaccinate their children

included higher educational level (AOR, 1.99; 95% CI, 1.26–3.34), stronger confidence in one's knowledge about safety measures (AOR, 1.23; 95% CI, 1.07–1.41), and regular information seeking about COVID-19 pandemic (AOR, 1.22; 95% CI, 1.00–1.48). Presence of family member in risk group (AOR, 0.59; 95% CI, 0.36–0.99) and stronger beliefs that policy measures were exaggerated (AOR, 0.60; 95% CI, 0.49–0.76) were associated with a lower intention to vaccinate their children.

The study of BNT162b2 vaccine in 12–15 year-old recipients reported that the observed vaccine efficacy was 100% (95% CI, 75.3–100) with a favorable safety profile.²⁷ The manufacture of mRNA-1273 vaccine announced on 6 May 2021 that the vaccine was 96% effective for adolescents ages 12–17 years after at least one dose without having serious safety concerns.²⁸ The American Academy of Pediatrics recommends COVID-19 vaccination for all children and adolescents 12 years of age and older who do not have contraindications for using a COVID-19 vaccine authorized for use for this age group.²⁹ The technical report of EU/EEA has noted that because COVID-19 is typically milder in healthy children and adolescents, vaccine uptake in older age groups should continue to be given a priority before targeting adolescents as a whole.⁹ Vaccination of adolescents who are at high risk of severe COVID-19 should be prioritized in the same way as vaccination for people in other age groups who are at a high risk of having a severe disease. The decision-making process for allocation and distribution of the limited number of COVID-19 vaccines is imperative and flexibility in adapting to strategies is essential as new information is constantly emerging.³⁰

Our study has some limitations. Since this survey was performed in one region of South Korea, it has limitations in reflecting the nationwide situation. In addition, selection bias could not be ruled out because the recruitment targeted survey subjects at tertiary university hospitals. The participants are likely to be associated with high risks for severe COVID-19, which may affect the intention to vaccinate against COVID-19. However, our study results were quite consistent with a recent national survey and previously reported studies. In addition, this study included children and adolescents aged 10–18 years in the survey subjects to investigate their intention to vaccinate themselves. There has been no report to explore children and adolescents' intention to vaccinate themselves.

In conclusion, this study provides insight into how parents are thinking about COVID-19 vaccine for their children in South Korea. Our findings could be referenced in establishing policies for COVID-19 vaccination for children in the future.

SUPPLEMENTARY MATERIALS

Supplementary Data 1

Survey of parents' perception of COVID-19 vaccination in children

[Click here to view](#)

Supplementary Data 2

Survey of perception of COVID-19 vaccination in children

[Click here to view](#)

REFERENCES

1. World Health Organization. WHO coronavirus (COVID-19) dashboard. <https://covid19.who.int/>. Updated 2021. Accessed June 13, 2021.
2. Randolph HE, Barreiro LB. Herd immunity: understanding COVID-19. *Immunity* 2020;52(5):737-41.
[PUBMED](#) | [CROSSREF](#)
3. Chen X, Chen Z, Azman AS, Deng X, Sun R, Zhao Z, et al. Serological evidence of human infection with SARS-CoV-2: a systematic review and meta-analysis. *Lancet Glob Health* 2021;9(5):e598-609.
[PUBMED](#) | [CROSSREF](#)
4. Hossain A, Nasrullah SM, Tasnim Z, Hasan MK, Hasan MM. Seroprevalence of SARS-CoV-2 IgG antibodies among health care workers prior to vaccine administration in Europe, the USA and East Asia: a systematic review and meta-analysis. *EclinicalMedicine* 2021;33:100770.
[PUBMED](#) | [CROSSREF](#)
5. Rostami A, Sepidarkish M, Leeftang MM, Riahi SM, Nourollahpour Shiadeh M, Esfandyari S, et al. SARS-CoV-2 seroprevalence worldwide: a systematic review and meta-analysis. *Clin Microbiol Infect* 2021;27(3):331-40.
[PUBMED](#) | [CROSSREF](#)
6. World Health Organization. COVID-19 vaccine tracker and landscape. <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>. Updated 2021. Accessed June 13, 2021.
7. World Health Organization. Emergency use listing procedure. COVID-19. <https://extranet.who.int/pqweb/vaccines/covid-19-vaccines>. Updated 2021. Accessed June 13, 2021.
8. U.S. Food and Drug Administration. Coronavirus (COVID-19) update: FDA authorizes Pfizer-BioNTech COVID-19 vaccine for emergency use in adolescents in another important action in fight against pandemic. <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-authorizes-pfizer-biontech-covid-19-vaccine-emergency-use>. Updated 2021. Accessed June 13, 2021.
9. European Centre for Disease Prevention and Control. Interim public health considerations for COVID-19 vaccination of adolescents in the EU/EEA. <https://www.ecdc.europa.eu/en/publications-data/interim-public-health-considerations-covid-19-vaccination-adolescents-eueea>. Updated 2021. Accessed June 13, 2021.
10. Korea Disease Control and Prevention Agency. Press release, coronavirus disease-19, Republic of Korea. http://ncov.mohw.go.kr/tcmBoardView.do?brdId=3&brdGubun=31&dataGubun=&ncvContSeq=5533&contSeq=5533&board_id=312&gubun=ALL. Updated 2021. Accessed June 13, 2021.
11. Kang HM, Choi EH, Kim YJ. Updates on the coronavirus disease 2019 vaccine and consideration in children. *Clin Exp Pediatr* 2021;64(7):328-38.
[PUBMED](#) | [CROSSREF](#)
12. Korea Disease Control and Prevention Agency. Press release, coronavirus disease-19, Republic of Korea. http://ncov.mohw.go.kr/tcmBoardView.do?brdId=&brdGubun=&dataGubun=&ncvContSeq=365562&contSeq=365562&board_id=&gubun=ALL. Updated 2021. Accessed June 10, 2021.
13. Imperial College London. Global attitudes towards a COVID-19 vaccine. https://www.imperial.ac.uk/media/imperial-college/institute-of-global-health-innovation/GlobalVaccineInsights_ICL-YouGov-Covid-19-Behaviour-Tracker_20210520_v2.pdf. Updated 2021. Accessed June 12, 2021.
14. Schwarzinger M, Watson V, Arwidson P, Alla F, Luchini S. COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics. *Lancet Public Health* 2021;6(4):e210-21.
[PUBMED](#) | [CROSSREF](#)
15. El-Elimat T, AbuAlSamen MM, Almomani BA, Al-Sawalha NA, Alali FQ. Acceptance and attitudes toward COVID-19 vaccines: a cross-sectional study from Jordan. *PLoS One* 2021;16(4):e0250555.
[PUBMED](#) | [CROSSREF](#)
16. Bell S, Clarke R, Mounier-Jack S, Walker JL, Paterson P. Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: a multi-methods study in England. *Vaccine* 2020;38(49):7789-98.
[PUBMED](#) | [CROSSREF](#)
17. Goldman RD, Marneni SR, Seiler M, Brown JC, Klein EJ, Cotanda CP, et al. Caregivers' willingness to accept expedited vaccine research during the COVID-19 pandemic: a cross-sectional survey. *Clin Ther* 2020;42(11):2124-33.
[PUBMED](#) | [CROSSREF](#)
18. Goldman RD, Yan TD, Seiler M, Parra Cotanda C, Brown JC, Klein EJ, et al. Caregiver willingness to vaccinate their children against COVID-19: cross sectional survey. *Vaccine* 2020;38(48):7668-73.
[PUBMED](#) | [CROSSREF](#)

19. Zhang KC, Fang Y, Cao H, Chen H, Hu T, Chen YQ, et al. Parental acceptability of COVID-19 vaccination for children under the age of 18 years: cross-sectional online survey. *JMIR Pediatr Parent* 2020;3(2):e24827. [PUBMED](#) | [CROSSREF](#)
20. Brandstetter S, Böhmer MM, Pawellek M, Seelbach-Göbel B, Melter M, Kabesch M, et al. Parents' intention to get vaccinated and to have their child vaccinated against COVID-19: cross-sectional analyses using data from the KUNO-Kids health study. *Eur J Pediatr*. Forthcoming 2021. DOI: 10.1007/s00431-021-04094-z. [PUBMED](#) | [CROSSREF](#)
21. The COVID States Project #45. Vaccine hesitancy and resistance among parents. <https://osf.io/e95bc/>. Updated 2021. Accessed June 10, 2021.
22. Montalti M, Rallo F, Guaraldi F, Bartoli L, Po G, Stillo M, et al. 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 (Basel)* 2021;9(4):366. [PUBMED](#) | [CROSSREF](#)
23. ParentsTogether. Early research on parental attitudes about the COVID-19 vaccination & children. https://parents-together.org/wp-content/uploads/2021/03/PT-Brief_-_Parental-Attitudes-about-COVID-19-Vaccine.pdf. Updated 2021. Accessed June 12, 2021.
24. Yigit M, Ozkaya-Parlakay A, Senel E. Evaluation of COVID-19 vaccine refusal in parents. *Pediatr Infect Dis J* 2021;40(4):e134-6. [PUBMED](#) | [CROSSREF](#)
25. Centers for Disease Control and Prevention. What clinicians need to know about Pfizer-BioNTech COVID-19 vaccination of adolescents. https://emergency.cdc.gov/coca/calls/2021/callinfo_051421.asp. Updated 2021. Accessed June 10, 2021.
26. Yilmaz M, Sahin MK. Parents' willingness and attitudes concerning the COVID-19 vaccine: a cross-sectional study. *Int J Clin Pract*. Forthcoming 2021. DOI: 10.1111/ijcp.14364. [PUBMED](#) | [CROSSREF](#)
27. Frenck RW Jr, Klein NP, Kitchin N, Gurtman A, Absalon J, Lockhart S, et al. Safety, immunogenicity, and efficacy of the BNT162b2 Covid-19 vaccine in adolescents. *N Engl J Med* 2021;385(3):239-50. [PUBMED](#) | [CROSSREF](#)
28. Moderna. Phase 2/3 "TeenCOVE" study of mRNA-1273 in adolescents. <https://investors.modernatx.com/news-releases/news-release-details/moderna-reports-first-quarter-fiscal-year-2021-financial-results>. Updated 2021. Accessed June 12, 2021.
29. Committee on Infectious Diseases. COVID-19 vaccines in children and adolescents. *Pediatrics*. Forthcoming 2021. DOI: 10.1542/peds.2021-052336. [PUBMED](#) | [CROSSREF](#)
30. Choi MJ, Choi WS, Seong H, Choi JY, Kim JH, Kim YJ, et al. Developing a framework for pandemic COVID-19 vaccine allocation: a modified Delphi consensus study in Korea. *J Korean Med Sci* 2021;36(23):e166. [PUBMED](#) | [CROSSREF](#)