

Pediatric COVID-19 Vaccine Refusal among Egyptian Parents: An Online Survey Study

Hend Magdy Mohamed Gomaa* & Shymaa Mamdouh Mohamed Abdu

Public health and Community medicine department, Faculty of medicine, Mansoura University, Mansoura, Egypt

Corresponding Author: Hend Magdy Mohamed Gomaa, *Email:* hendmagdy86@hotmail.com,

*Mobile:*00201009780105

ABSTRACT

Background: Because COVID-19 pandemic is still ongoing, it is critical to immunize the majority of people, including children, in order to achieve herd immunity.

Objective: The study aimed to estimate prevalence of pediatric COVID-19 vaccine refusal among parents and to explore factors affecting it.

Methods: An online cross-sectional survey of 189 parents was conducted. Data were collected using a pre-structured questionnaire about parents' socio-demographic characteristics, COVID-19 knowledge, level of concern about reinfection, parents' willingness to vaccinate their children, and the importance of vaccine to their own and community health. To identify predictors of vaccine refusal, binary logistic regression was used.

Results: The majority of parents (61.9%) refused the pediatric COVID-19 vaccine. Binary logistic regression analysis showed that male parents (AOR= 10.18,95), those tested negative (AOR=26.27), those not worried from reinfection (AOR= 15.23), those felt anxious more than half the days (AOR=10.64), nearly every day (AOR= 15) and those who thought that the vaccine was not important for their own health (AOR=11.93) and for protecting health of other people (AOR=4.05) were significantly more likely to refuse the pediatric COVID-19 vaccine. 73.5% and 63.2% of parents had fear of vaccine side effects and thought that vaccine isn't effective, respectively.

Conclusion: Pediatric COVID-19 vaccines are opposed by two-thirds of parents. Fear of vaccine side effects and belief that the vaccine is not effective are the most common reasons for vaccine rejection. As a result, health education for those parents and future longitudinal studies exploring the factors influencing parents' refusal of the COVID-19 vaccine are recommended.

Keywords: COVID-19 vaccines, Children, parents.

INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic and declared a global health emergency ⁽¹⁾. The quick licensing of COVID-19 vaccinations serves as an essential preventative step against the pandemic with unabated increase in new cases, achieve herd immunity, and avoid hospitalization and death. ^(2, 3). COVID-19 vaccine trials illustrated encouraging results as regards safety and production of a good immune response and shows effectiveness in disease control ^(4, 5). To combat the pandemic, good awareness of vaccination needs to be done. The COVAX initiative was implemented among lower-income countries to make faster and more equitable distribution of the vaccines with the following achievements; 65.8% of the world population had received at least one dose of a COVID-19 vaccine, of them 16.2% of people in low-income countries ⁽⁶⁾.

With rates of uptake among the community enhancing the success of the immunization campaign, more worry has been created over the expansion of COVID-19 vaccination to youngsters. ⁽⁷⁾. Some people are less confident in national safety monitoring systems due to possible side effects of vaccination, which cause them to put off getting vaccinated, delay getting vaccinated, and strongly oppose vaccination. Younger adults provide a challenge since they are less clinically impacted and may believe that receiving the COVID-19 vaccine has less utility ⁽⁸⁾. Additionally, false information about the COVID-19 vaccine has been

spread via social media channels ⁽⁹⁾, that is exacerbated by widespread vaccine misinformation, which is already very high ⁽¹⁰⁾.

The difficulty for a COVID-19 vaccine is that its fast development contributed to the perception that the vaccine hasn't been thoroughly vetted for safety and efficacy, which is why the WHO now considers it to be a severe global health hazard ⁽¹¹⁾. Mild symptoms, few hospitalizations, and lower mortality rates among children than adults may all contribute to hesitation in administering vaccines to younger individuals ⁽¹²⁾. As a result, 33.3% of Egyptians had received all recommended vaccinations as of May 28, 2022⁽⁶⁾. Despite the Egyptian government's approval of Pfizer's Covid-19 vaccination for youngsters aged 12 to 15, many families were still reluctant to vaccinate both themselves and their children ⁽¹³⁾. There are few studies looking at how well the COVID-19 vaccine is received by children, particularly in low- and middle-income countries (LMICs), despite the fact that there is a significant amount of research on adults' uptake of the COVID-19 immunization ^(14, 15). The first study to use an online survey to highlight this crucial subject comes from Egypt.

SUBJECTS AND METHODS

A descriptive cross-sectional study with analytical components that was carried out through online survey on accessible parents through year 2022.

Inclusion criteria: Having at least one child < 18 years and accept to participate in the study by informed verbal consent.

Sample size calculation was based on refusal rate of vaccination among African countries retrieved from previous research ⁽¹⁶⁾. Using Epi info version 7.2.4.0 to calculate sample size based to 87.6% prevalence, 95% CL with acceptable margin of error = 5, then the total sample size was 167 and by adding 15% to compensate for possible incomplete responses or non responders, then total sample size was 193 at least.

Pre-structured questionnaire was adopted from the International Citizen Project (ICP) COVID-19 available at <https://www.icpcovid.com/en/form/covid-19-vaccine-survey>. The protocol and questionnaire for this survey is largely based on the citizen science. Corona survey first launched in Belgium by the University of Antwerp (team: Philippe Beutels, Niel Hens, Koen Pepermans & Pierre Van Damme) on 17th March 2020. First part asking about personal data, such as age, sex, place of residence, degree of education, employment in the healthcare industry and self-perceived socioeconomic situation. In the second section, participants were questioned about their health, knowledge of COVID-19, level of fear/worry about contracting the disease, likelihood of contracting COVID-19 again after recovering from a prior infection, likelihood of being prevented from contracting COVID-19 by vaccination, and existence of a COVID-19 vaccine that is currently effective. The third section included three questions about participants' desire to immunize kids against COVID-19 and the value of the vaccine for their own and the community's health.

Statistical analysis

SPSS (statistical package for social sciences) version 28 was used to analyse the data. Frequencies and relative frequencies were used to present qualitative data. The Chi-Square test was used to compare categorical variables in bivariate analysis, and binary logistic regression was used to detect potential predictors of refusal, with the adjusted odds ratio and overall percent predicted calculated. $P \leq 0.05$ is considered significant.

Ethical consideration:

Each participant who shared data in the study gave informed written consent after the confidentiality of the information had been established. The Faculty of Medicine at Mansoura University's IRB committee gave the study proposal approval with the acceptance code "R.22.06.1722.R1". This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

RESULTS

The current study was carried out on 193 parents who met the inclusion criteria for the study with response rate of the online survey was 189/193(97.9%). Mean age (SD) of the studied parents was 34.69(5.44) ranging from 25 to 59 years, 82% of them were females, 65.6% urban residence, 75.1% are university education and higher, 69.8% are living with child <12 years, 37.6% were health care workers and 77.8% had middle socio-economic status. Sixty-two percent of the studied parents did not accept to give their children COVID-19 vaccinating. A statistically significant relation was detected between sex of the studied parent and not accepting vaccine; 91.2% of males are not accepting vaccine (Crude odds ratio: 8.29) as shown in table (1).

Parents who don't have information on their infection status or those not tested since the beginning of the COVID-19 pandemic had statistically significant relation with their refusal of the vaccine (73.3% of them refused vaccine with odds ratio: 2.53). Parents who were not worried at all or a little worried of becoming re-infected by the coronavirus have statistically significant higher refusal than parents who were extremely worried (odds ratio=16.38 & 4.56 respectively). Parents who reported feeling nervous, anxious or on edge more than half the days during the past two weeks have statistically significant lower refusal rate that cases not feeling nervous at all. Parents who thought that a vaccine cannot prevent COVID-19 infection have a higher refusal frequency than parents who did not know, with a statistically significant relationship between them.

Eighty-six percent of parents who discovered that there was no currently effective COVID-19 vaccine are refusing pediatric vaccine (odds ratio=16.41). A statistically significant relation is detected between parental refusal of pediatric COVID-19 vaccine and their own assessment of the importance of getting the vaccine; 86.6% & 80.7% of the parents who find that getting vaccine is not important to their own health and in protecting the community refused pediatric vaccination (odds ratio=18.43 & 8.36, respectively) as shown in table (2).

Multivariate analysis showed that the following were statistically significant predictors of parental refusal of pediatric vaccine; males, parents who tested negative or not tested during COVID-19 pandemic, parents who were not at all worried and those who were feeling nervous more than have of days or nearly every day, parents who found that vaccine is not important for their health and for community health with the overall percent predicted =97.5%. Among causes of not accepting the vaccine; 73.5% scared of side-effects of the vaccine, 63.2% thought that vaccine is not effective, 11.1% thought that their child is immune against the disease, 9.4% thought that COVID-19 pandemic is finished in their country and 0.9% did not think that COVID-19 exists as shown in table (3) and figure (1).

Table (1): Relation between parental refusal of pediatric COVID-19 and their sociodemographic characteristics

Demographic information	Total number =189	Not accepting pediatric COVID-19 vaccine (61.9%)	P value	Crude Odds ratio (95% CI)
Age/years				
25- (r)	122	75(61.5)	0.87	1
36-59	67	42(62.7)		1.05(0.56-1.95)
Sex				
Male	34	31(91.2)	<0.001*	8.29(2.43-28.3)
Female (r)	155	86(55.5)		1
Residence:				
Rural (r)	124	73(58.9)	0.236	1
Urban	65	44(67.7)		1.46(0.779-2.75)
Highest educational level				
secondary education or less	47	31	0.509	1.26(0.632-2.52)
University or higher (r)	142	86(60.6)		1
Having child aged				
<12 years	186	114(61.3)	0.417	1.26(0.722-2.19)
12-17 years (r)	70	39(55.7)		1
Worker in the healthcare sector				
No	118	74(62.7)	0.768	1.09(0.598-2.01)
Yes (r)	71	43(60.6)		
Self-reported socio-economic situation				
Low & Middle income	153	98(64.1)	0.210	1.59(0.766-3.32)
High income (r)	36	19(52.8)		1

Used tests: Chi-Square test (r): reference group *statistically significant

Table (2): Relation between parental knowledge, symptomatology and their refusal of pediatric COVID-19

	Total number =189	Not accepting pediatric COVID-19 vaccine n=117 (61.9%)	P value	Odds ratio (95% CI)
<u>Source of covid-19 information/advice</u>				
Family and friends	23	18(78.3)	0.08	2.44(0.863-6.88)
Radio / TV	36	22(61.1)	0.913	0.959(0.455-2.02)
Social Media (WhatsApp, Facebook, Twitter, etc)	71	40(56.3)	0.221	0.687(0.376-1.26)
Health personnel	20	12(60.0)	0.853	0.914(0.355-2.36)
Religious authorities (Pastor, Priest, Imam, etc)	8	6(75.00)	0.692	0.85(0.379-1.90)
others#	31	19(61.3)	0.938	0.969(0.439-2.14)
Currently working/studying from home because of the covid-19 outbreak				
No	142	88(62.0)	0.974	1.01(0.513-1.99)
Yes (r)	47	29(61.7)		
Have been quarantined during COVID-19 pandemic	111	71(64.0)	0.487	1.23(0.681-2.24)
Have information on infection status Since the beginning of the covid-19 outbreak				
Tested positive (r)	98	51(52)	0.063	1
Tested negative	31	22(71.0)		2.25(0.942-5.38)
Not tested / don't know test results	60	44(73.3)		2.53(1.26-5.08)
Worried/fearful of becoming (re)infected by the coronavirus				
Not at all worried	64	53(82.8)	<0.001*	16.38(4.98-53.85)
A little worried	103	59(57.3)		4.56(1.56-13.30)
Extremely worried (r)	22	5(22.7)		R

	Total number =189	Not accepting pediatric COVID-19 vaccine n=117 (61.9%)	P value	Odds ratio (95%CI)
Have any of the following chronic/underlying diseases				
• Heart disease	5	4(80.0)	0.651	2.51(0.275-22.94)
• Hypertension	28	18(64.3)	0.779	1.13(0.489-2.59)
• Diabetes	12	5(41.7)	0.136	0.415(0.126-1.36)
• Asthma	34	20(58.8)	0.683	0.854(0.40-1.82)
• None of the above	128	80(62.5)	0.807	1.08(0.578-2.02)
Observing any of the following preventive measures against COVID-19				
Social distancing of at least 1.5m	3	2(66.7)	1.0	1.23(0.11-13.87)
Wearing face mask	23	15(65.2)	0.727	1.17(0.47-2.93)
Hand hygiene	19	12(63.2)	0.906	1.06(0.397-2.83)
Coughing hygiene	17	10(58.8)	0.784	0.867(0.315-2.39)
None of the above	161	99(61.5)	0.779	0.887(0.385-2.05)
During the past two weeks, frequency of having bothered by each of the following symptoms				
Feeling down, depressed, or hopeless (low spirits)	43	26(60.5)		1
Not at all (r)	100	58(58.0)	0.783	0.903(0.436-1.87)
More than half the days	46	33(71.7)	0.260	1.66(0.684-4.03)
Nearly every day				
Little interest or pleasure in doing things				
Not at all(r)				1
More than half the days	43	26(60.5)	0.940	0.972(0.467-2.03)
Nearly every day	97	58(59.8)	0.492	1.35(0.574-3.17)
	49	33(67.3)		
Feeling nervous, anxious or on edge				1
Not at all(r)	37	22(59.5)		
More than half the days	100	58(58.0)	0.014*	0.357(0.155-0.823)
Nearly every day	52	37(71.2)	0.250	1.68(0.691-4.09)
Not being able to stop or control worrying				1
Not at all(r)	45	27(60)		
More than half the days	120	75(62.5)	0.768	1.11(0.551-2.24)
Nearly every day	24	15(62.5)	0.839	1.11(0.401-3.08)
Re-infection with coronavirus after recovering from a previous COVID-19 infection is possible	183	114(62.3)	0.676	1.65(0.324-8.42)
COVID-19 infection can be prevented by a vaccine	36	16(44.4)		1
Don't know (r)	60	15(25.0)	0.04*	0.417(0.173-1.0)
Yes	93	86(92.5)	<0.001	15.36(5.58-42.28)
No			*	
Currently an effective vaccine against COVID-19 is present				
Don't know /No	121	101(86.3)	<0.001	16.41(7.85-34.32)
Yes(r)	68	16(13.7)	*	1
Importance of getting the COVID-19 vaccine, to protect				
<u>Parent's own health</u>				
Not important	112	97(86.6)	<0.001	18.43(8.75-38.83)
Important (r)	77	20(26.0)	*	1
<u>protect the health of other people in your community</u>				
Not important	114	92(80.7)	<0.001	8.36(4.29-16.32)
Important (r)	75	25(33.3)	*	1

#others include read about it and at workused tests: Chi-Square test (r): reference group *statistically significant

Table (3): Binary logistic regression for predictors of parental refusal of pediatric vaccine

Predictors	β	P-value	Adjusted odds ratio (95% CI)
Sex			
Male	4.68	0.001*	10.18(7.11-16.28)
Female (r)			1
Have information on infection status Since the beginning of the COVID-19 outbreak			
Tested positive (r)			1
Tested negative	5.91	<0.001*	26.27(18.42-30.56)
Not tested / don't know test results	3.44	0.002*	20.14(3.4-25.15)
Worried/fearful of becoming (re)infected by the coronavirus			
Not at all worried	4.91	0.006*	15.23(4.19-28.79)
A little worried	1.14	0.429	3.13(0.182-20.56)
Extremely worried (r)			1
COVID-19 infection can be prevented by a vaccine			
Don't know (r)			1
Yes	-0.224	0.881	0.799(0.043-15.01)
No	2.77	0.125	16.07(0.464-58.1)
Currently an effective vaccine against COVID-19 is present			
Don't know /No (r)			1
Yes	-1.77	0.213	0.171(0.01-2.75)
Feeling nervous, anxious or on edge			
Not at all(r)			1
More than half the days	2.37	0.042*	10.64(1.09-15.48)
Nearly every day	4.11	0.009*	15(8.59-18.95)
Parent's own health			
Not important	2.47	<0.001*	11.93(5.46-26.11)
Important (r)			1
protect the health of other people in your community			
Not important	1.4	<0.001*	4.05(1.85-8.88)
Important (r)			1
Overall percent predicted =97.5%.			

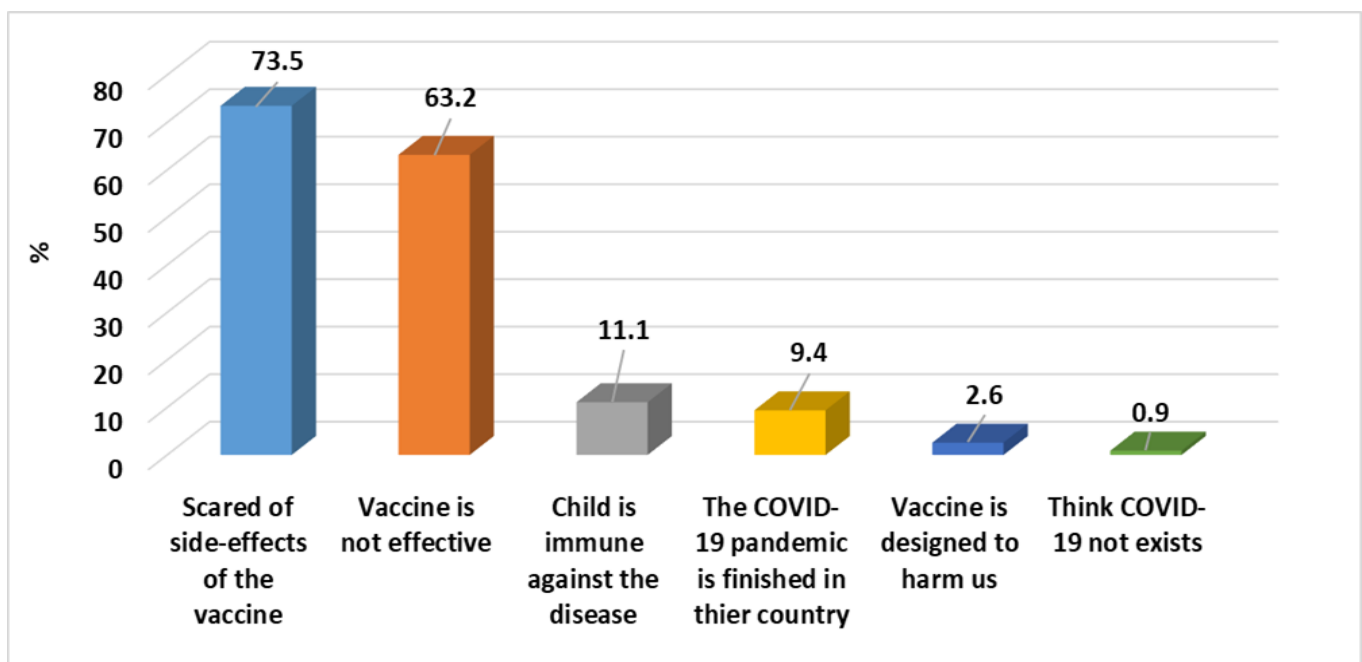


Figure (1): Reasons hindering giving vaccine to their children

DISCUSSION

Vaccination is one of the most effective scientific interventions for controlling and even eradicating many infectious diseases. This is the first Egyptian study to look at the prevalence of parental refusal of the pediatric COVID-19 vaccine and the factors that contribute to it. Vaccine hesitancy (VH) is the refusal or delay in accepting vaccination despite the existence of vaccination services⁽¹⁷⁾. The present study reported high level of refusal toward vaccinating children with COVID-19 vaccine among their parents (61.9%). In line with our study, previous studies in Arab countries reported higher rates of VH; Jordan (62.6%)⁽¹⁸⁾, and in a small multinational poll of several countries, primarily Jordan and Kuwait (70.6%)⁽¹⁹⁾. On the contrary, previous studies found low levels of VH, Indonesia (5.7%)⁽²⁰⁾ and China (6.7%)⁽²¹⁾. The variation in VH is caused by a combination of demographic, socioeconomic, cultural, and/or geographic factors. In order to understand the reasons for vaccine refusal and the factors influencing it, future immunization programs must identify parental hesitancy of COVID-19 vaccines.

Our findings reported that fathers had significant higher odd of pediatric COVID-19 refusal than women. Similarly, only a previous study in Poland⁽²²⁾ found that females showed positive attitude toward the vaccine than males. We can explain that there is a difference in the societal role between males and females in our society and males listened more to negative information from their friends and experienced a fear toward long term side effects of the vaccine. However, previous studies found that females were more hesitant than males^(23, 24). This necessitates future studies to examine the effect of gender dynamics.

The current study discovered that parents who were tested negative, did not test, or did not know the result of the test were significantly more likely to refuse the vaccine than those who were tested positive. A previous study in Bangladesh⁽²⁵⁾ found that parents who did not test positive for COVID-19 had a higher risk of VH. Also, a previous study that was conducted in selected lower and middle income countries (LMICs) found that parents with test negative for COVID-19 had lower odds of accepting the vaccine⁽¹⁶⁾. Therefore, it can be assumed that negative disease perception made parents to refuse the vaccine. A previous study, on the other hand, found no link between family members infected with COVID-19 and their willingness to immunize their child⁽²⁶⁾.

Moreover, the present study found that parents who were not at all worried about catching COVID-19 rejected the pediatric vaccine at a statistically significantly higher rate than those who were extremely worried. This is similar to a previous study⁽¹⁶⁾. As a result, fear or worry could be used to motivate children to get vaccinated and attain herd immunity.

The current study showed that parents with moderate and severe anxiety were significantly more likely to experience higher vaccine refusal. Two studies were found in Turkey, one of which was in line with our results⁽²⁷⁾ and the other rejected it⁽²⁸⁾. Therefore, it is necessary to examine the effect of anxiety and stress level on refusal of pediatric vaccination in future studies.

The bivariate analysis showed that parents knew about COVID-19 vaccine had significantly lower odds of vaccine refusal. Such result agrees with a finding reported by **Bono *et al.***¹⁶ who found that parents who knew about COVID-19 vaccine were more likely to accept vaccination for their children. However, this finding contradicts with a previous study in Korea⁽²⁹⁾, which revealed that perceived knowledge of COVID-19 was significantly associated with vaccine refusal. The difference between studies is attributed to difference in socio-demographic and cultural aspects of participants. The bivariate analysis revealed that parents who hadn't perceived and did not know the effectiveness of vaccine were more significantly more likely to refuse it. Similarly, a previous study in Bangladesh reported that parents didn't perceive vaccine effectiveness had higher odds of vaccine refusal⁽³⁰⁾. This is indicating the role of perception of vaccine effectiveness in the success of vaccination programs.

In our study, parents who thought that vaccine is not important for protection of others and their own health were significantly more likely to refuse pediatric COVID-19 vaccine. A previous study found that self-protection and protecting children from COVID-19 were the main drivers of vaccine approval⁽¹⁶⁾.

The present study found that parents received information from their families and friends had higher odds of vaccine refusal. **Schilling *et al.***⁽³¹⁾ supported that finding, but a previous study⁽³²⁾ found that family as a source of information decreased VH. This pointing to the negative effect of friends in spreading negative information about the vaccine in LMICs. However, those received information from social media and health personnel had lower odds of vaccine refusal with no statistical significant difference. This is similar to be found by **Alfieri *et al.***⁽³²⁾. This is indicating that social media and health personnel were powerful channels for spreading positive messages about pediatric COVID-19 vaccine and helping the public to access to a scientific evidence.

The current study demonstrated that the most common cause of VH is the fear of side effects of vaccine and non-trust in vaccine effectiveness. Similarly, previous studies supported this finding^(28, 14). To reduce vaccine hesitance, direct interaction with communities through influencers such as community leaders and health professionals is required. Furthermore, open lines of communication and the support of health care workers are essential (HCWs)⁽³³⁾.

CONCLUSION AND RECOMMENDATIONS

The effective broadcasting and implementation of public health strategies may be impeded by VH to combat the global pandemic of COVID-19. The pediatric COVID-19 vaccine was opposed by two-thirds of parents. Males, those with negative tests, those who had not been tested and did not know the results, those who were not worry from reinfection by COVID-19 infection, and those with anxiety were all significant predictors of a higher odds of VH. Fear of vaccine side effects and the belief that the vaccine is ineffective were the most common reasons for vaccine refusal. As a result, psychological support for those parents is recommended, as are future longitudinal studies into the factors influencing parents' acceptability and refusal of the COVID-19 vaccine.

STRENGTHS AND LIMITATIONS

The strength of the study is that it is the first Egyptian study that aimed to determine the prevalence rate of parents' refusal to vaccinate their children against COVID-19 disease and the factors associated with acceptance and refusal of vaccination. But there are some limitations: first, cross-sectional study can only provide researchers with a snapshot of a population at a single point in time and cannot capture changes in COVID-19 vaccine acceptability and hesitancy over time. Second, the small size of the sample collected through an online survey, its results cannot be generalized in the community. Third, we need many future studies that reveal the rate of parents' refusal to vaccinate their children against COVID-19 and the factors associated with that.

Competing interests: The authors declared that they have no competing interests.

Funding: The author(s) reported there was no funding associated with the work featured in this article.

Acknowledgements: The authors thank all the participants who voluntarily participate in this study.

Author contribution: Authors contributed equally in the study.

REFERENCES

1. **World Health Organization (2021): Rolling Updates on Coronavirus Disease (COVID-19)** . Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2021/events-as-they-happen> (accessed on 17 September 2022).
2. **Centers for Disease Control and Prevention (2021): COVID-19 vaccine emergency use authorization (EUA) fact sheets for recipients and caregivers.** <https://www.cdc.gov/vaccines/covid-19/eua/index.html>
3. **World Health Organization (2021): Statement for Healthcare Professionals: How COVID-19 Vaccines Are Regulated for Safety and Effectiveness.** Available online: <https://www.who.int/news/item/11-06-2021-statement-for-healthcare-professionals-howcovid-19-vaccines-are-regulated-for-safety-and-effectiveness>
4. **Zhu F, Guan X, Li Y *et al.* (2020):** Immunogenicity and safety of a recombinant adenovirus type-5-vectored COVID-19 vaccine in healthy adults aged 18 years or older: a randomised, double-blind, placebo-controlled, phase 2 trial. *Lancet*, 396 (10249): 479-88. [https://doi.org/10.1016/s0140-6736\(20\)31605-6](https://doi.org/10.1016/s0140-6736(20)31605-6)
5. **Folegatti P, Ewer K, Aley P *et al.* (2020):** Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial. *Lancet*, 396 (10249): 467-78. [https://doi.org/10.1016/s0140-6736\(20\)31604-4](https://doi.org/10.1016/s0140-6736(20)31604-4)
6. **Our World in Data (2021) :** People Fully Vaccinated per Hundred. Available online: <https://ourworldindata.org/grapher/share-peoplefully-vaccinated-covid?tab=table>
7. **Centers for Disease Control and Prevention (2021):** COVID-19 Vaccines for Children and Teens. Available online: <https://www.cdc.gov/coronavirus/2019ncov/vaccines/recommendations/children-teens.html>
8. **Singh L, Bansal S, Bode L *et al.* (2020):** A first look at COVID-19 information and misinformation sharing on Twitter. <https://arxiv.org/abs/2003.13907>
9. **World Health Organization (2019):** Ten Threats to Global Health in 2019. Available online: <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>
10. **Cornwall W (2020):** Just 50% of Americans Plan to Get a COVID-19 Vaccine. Here's How to Win Over the Rest. Available online: <https://www.sciencemag.org/news/2020/06/just-50-americans-plan-get-covid-19-vaccine-here-s-how-win-over-rest>
11. **Chirumbolo S (2021):** Vaccination hesitancy and the "myth" on mRNA-based vaccines in Italy in the COVID-19 era: Does urgency meet major safety criteria? *J Med Virol.*, 93 (7): 4049-53. <https://doi.org/10.1002/jmv.26922>
12. **Zimmermann P, Curtis N (2020):** Why is COVID-19 less severe in children? A review of the proposed mechanisms underlying the age-related difference in severity of SARS-CoV-2 infections. *Arch Dis Child.* <https://doi.org/10.1136/archdischild-2020-320338>
13. **Dalia Y (2022):** COVID-19 vaccines reach remote areas of Egypt. Available: <https://www.unicef.org/egypt/stories/covid-19-vaccines-reach-remote-areas-egypt>
14. **Moola S, Gudi N, Nambiar D *et al.* (2021):** A rapid review of evidence on the determinants of and strategies for COVID-19 vaccine acceptance in low- and middle-income countries. *J Glob Health*, 11:05027. <https://doi.org/10.7189/jogh.11.05027>
15. **Bagateli L, Saeki E, Fadda M *et al.* (2021):** COVID-19 Vaccine Hesitancy among Parents of Children and Adolescents Living in Brazil. <https://doi.org/10.3390/vaccines9101115>
16. **Bono S, Siau C, Chen W *et al.* (2021):** Adults' Acceptance of COVID-19 Vaccine for Children in Selected Lower- and Middle-Income Countries. <https://doi.org/10.3390/vaccines10010011>
17. **MacDonald N (2015):** Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 33 (34): 4161-4. <https://doi.org/10.1016/j.vaccine.2015.04.036>
18. **El-Elmat T, AbuAlSamen M, Almomani B *et al.* (2021):** Acceptance and attitudes toward COVID-19

- vaccines: A cross-sectional study from Jordan. PLoS One, 16 (4): e0250555. <https://doi.org/10.1371/journal.pone.0250555>
19. **Al-Mohaithef M, Padhi B (2020):** Determinants of COVID-19 Vaccine Acceptance in Saudi Arabia: A Web-Based National Survey. J Multidiscip Healthc., 13: 1657-63. <https://doi.org/10.2147/jmdh.s276771>
20. **Harapan H, Wagner A, Yufika A et al. (2020):** Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia. Front Public Health, 8: 381. <https://doi.org/10.3389/fpubh.2020.00381>
21. **Wang J, Jing R, Lai X et al. (2020):** Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. <https://doi.org/10.3390/vaccines8030482>
22. **Babicki M, Pokorna-Kalwak D, Doniec Z et al. (2021):** Attitudes of Parents with Regard to Vaccination of Children against COVID-19 in Poland. A Nationwide Online Survey. <https://doi.org/10.3390/vaccines9101192>
23. **Ruiz J, Bell R (2022):** Parental COVID-19 Vaccine Hesitancy in the United States. <https://doi.org/10.1177/00333549221114346>
24. **Salazar T, Pollard D, Pina-Thomas D et al. (2022):** Parental vaccine hesitancy and concerns regarding the COVID-19 virus. J Pediatr Nurs., 65 : 10-15. <https://doi.org/10.1016/j.pedn.2022.03.010>
25. **Ali M, Proma T, Tasnim Z et al. (2022):** Parental COVID-19 vaccine hesitancy for children with neurodevelopmental disorders: a cross-sectional survey. Trop Med Health., 50 (1): 24. <https://doi.org/10.1186/s41182-022-00415-6>
26. **Malik A, McFadden S, Elharake J et al. (2020):** Determinants of COVID-19 vaccine acceptance in the US. E Clinical Medicine, 26: 100495. <https://doi.org/10.1016/j.eclinm.2020.100495>
27. **Yilmazbas P, Terzi O, Ozceker D (2021):** Did. Covid-19 Pandemic Changed Parents' Approach To Vaccination. Soc Behav., 43 (2):130-4.
28. **Akarsu B, Canbay Özdemir D, Ayhan Baser D et al. (2021):** While studies on COVID-19 vaccine is ongoing, the public's thoughts and attitudes to the future COVID-19 vaccine. Int J Clin Pract., 75 (4): e13891. <https://doi.org/10.1111/ijcp.13891>
29. **Lee H, Choe Y, Kim S et al. (2022):** Attitude and Acceptance of COVID-19 Vaccine in Parents and Adolescents: A Nationwide Survey. J Adolesc Health., 71 (2): 164-71. <https://doi.org/10.1016/j.jadohealth.2022.05.018>
30. **Ali M, Ahmed S, Bonna A et al. (2022):** Parental coronavirus disease vaccine hesitancy for children in Bangladesh: a cross-sectional study. F1000Res., 11: 90. <http://doi:10.12688/f1000research.76181.2>
31. **Schilling S, Orr C, Delamater A et al. (2022):** COVID-19 vaccine hesitancy among low-income, racially and ethnically diverse US parents. Patient Educ Couns., 105 (8): 2771-7. <https://doi.org/10.1016/j.pec.2022.03.023>
32. **Alfieri N, Kusma J, Heard-Garris N et al. (2021):** Parental COVID-19 vaccine hesitancy for children: vulnerability in an urban hotspot. BMC Public Health, 21 (1): 1662. <https://doi.org/10.1186/s12889-021-11725-5>
1. **33. Gallè F, Sabella E, Roma P et al. (2021):** Knowledge and Acceptance of COVID-19 Vaccination among Undergraduate Students from Central and Southern Italy. <https://doi.org/10.3390/vaccines9060638>