Parental Hesitancy and Perception Regarding Vaccination of their Children Against COVID-19: A Cross-Sectional Study

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Abstract

Background: Despite the recognized importance of COVID-19 vaccination in reducing disease transmission and severity, vaccine hesitancy remains a barrier to immunizing children. Parental concerns, particularly regarding vaccine safety and necessity, significantly influence childhood vaccination uptake. **Aim:** This study aimed to assess parental hesitancy and perceptions regarding vaccinating their children against COVID-19. **Methods:** A descriptive cross-sectional study was conducted using a non-probability purposive sample of 555 parents attending outpatient clinics at Zagazig University Hospitals and Al-Mabra Hospital in Zagazig City. **Tools:** Data were collected using a validated self-administered questionnaire, including the Oxford COVID-19 Vaccine Hesitancy Scale. **Results:** More than half of the parents (52%) refused to vaccinate their children against COVID-19, mainly due to concerns about insufficient long-term studies, vaccine side effects, and perceptions of low risk in children. Regression analysis identified maternal education and prior awareness of vaccine availability as significant predictors of increased hesitancy. The main sources of information were the media and the internet, while trust in physicians increased the likelihood of vaccine acceptance. **Conclusion :** Parental hesitancy toward COVID-19 vaccination for children was high, mainly due to concerns about safety, side effects, and perceived low risk. Hesitancy was significantly influenced by maternal education and prior knowledge of vaccine availability. Trust in physicians promoted acceptance, while media and internet sources contributed to doubts. Addressing misconceptions through targeted education and trusted communication is essential to improve vaccine uptake. **Recommendations:** Efforts should focus on enhancing parental awareness through evidence-based education, strengthening physician- nurses -parent communication, and leveraging trusted information sources to counter misinformation and improve vaccine acceptance among parents.

Key words: COVID-19 Vaccine, Parental Hesitancy,Perception.

Introduction

The Coronavirus disease 2019 (COVID-19) is a global public health emergency **(Caserotti et al., 2021)** that directly affects the physical and mental health of people around the world and has serious indirect socio-economic effects **(Schneider et al., 2021)**. From the early beginning of the pandemic, children were reported to be at lower risk for COVID-19 **(Wu & McGoogan, 2020).** Even when they get infected, they are less symptomatic with fewer rates of hospitalization and fatalities than adults **(Rehman et al., 2020)**. Despite this, the COVID-19 pandemic affected children in various ways including the immediate socioeconomic impacts of lockdown, and exacerbation of the learning crisis due to school closures, moreover, the delayed implementation of sustainable developmental goals can have a profound impact on all children in all countries especially the most marginalized such as those living on the street or in refugee camps fare **(United Nations Sustainable Group , 2020; hub, 2021)**.

Governments around the world had to enforce stringent precautionary measures in attempts to control the virus spread **(Dryhurst et al., 2020; Wise et al., 2020)**.

On March 24, 2020, the Egyptian government started lockdown measures for virus containment, including a two-week curfew, which was later extended to a month, shutdown of schools and all educational institutions, restrictions on public events, a stay-at-home order except for essential trips, restrictions on internal movements, and total border closure **(Ragui Assaad etal., 2022)**. Although these precautionary measures reduced the virus transmission, vaccination is the only means of controlling the pandemic. The success of vaccination relies mainly on public acceptance and willingness to be vaccinated **(Bell et al., 2020; Pogue et al., 2020)**.

Mistrust in the vaccine, concerns regarding its adverse effects, and negative attitudes toward vaccination may hinder the long-term management of COVID-19 **(Paul et al., 2021)**. Delay in accepting and refusing vaccination despite the availability of vaccination services is called vaccine hesitancy **(MacDonald, 2015)**. Vaccine hesitancy is emerging as a significant challenge to vaccination efforts and was recognized by the World Health Organization as one of the top ten global health threats in 2019 **(Nuwarda et al., 2022)**.

Identifying differences in COVID-19 vaccine hesitancy across communities and demographic groups is key to recognizing where current vaccine information may not be enough to encourage uptake. This understanding can help tailor communication and distribution strategies for hesitant populations. Involving children and their parents is crucial to achieving herd immunity and ultimately eradicating disease, which are the primary objectives of all vaccination programs. **(Alfieri et al., 2021)**.

Significance of the study

The vaccine hesitancy is defined as "the delay in acceptance or refusal of vaccination despite availability of vaccination services" (**Centers for Disease Control and Prevention, 2022)**. Despite the benefits of the COVID-19 vaccine for children, parental hesitancy regarding vaccinating their children is still a sensitive topic. Parents expressed worries about children's vaccinations, particularly concerning the COVID-19 vaccine, raising concerns about its safety and effectiveness. So, the important of the current study come to evulate the parent hesitancy regarding vaccination of their children against COVID-19.

Aim of the study

The present study aimed to determine Parental hesitancy and perception regarding vaccination of their children against COVID-19.

Research questions

1. What is the level of parents' knowledge and perceptions regarding the COVID-19 vaccine for children?
2. What is the level of parental hesitancy toward vaccinating their children against COVID-19?
3. What are the misconceptions parents hold about the safety and effectiveness of the COVID-19 vaccine?
4. How do parents' sociodemographic characteristics influence their knowledge, perceptions, and hesitancy?
5. What are the differences in knowledge, perception, and hesitancy between parents who choose to vaccinate their children and those who do not?

Operational definition

Parental vaccine hesitancy in this study refers to the delay in acceptance or refusal of COVID-19 vaccination for children despite the availability of vaccination services. It includes concerns, beliefs, and attitudes expressed by parents regarding the safety, efficacy, and necessity of the COVID-19 vaccine for their children. Hesitancy levels were measured using the Oxford Covid-19 Vaccine Hesitancy Scale, along with a

structured questionnaire that assessed parents' willingness to vaccinate their children, their reasons for refusal or acceptance, and the influencing factors, such as knowledge, perceptions, and sources of information, were used.

Research Design

A descriptive cross-sectional study design was used to assess parents' hesitancy and perception regarding COVID-19 vaccination for their children.

Setting

The study was conducted in the outpatient clinics of Zagazig University Hospitals and Al-Mabra Hospital in Zagazig City.

Study Subjects

A sample composed of 555 parents participated in the study. **Inclusion criteria included**

- Parents of children who are aged between 6 months and 18 years
- Parents who were healthcare professionals or refused to complete the questionnaire were excluded.

Sampling Technique

A non-probability purposive sampling method was used. Data were collected over a period of six months from January 2022 to June 2022, and it was collected from parents attending outpatient clinics, as mentioned before, and they met the study inclusion criteria. This approach was selected due to accessibility and feasibility during the COVID-19 pandemic**.**

Calculation of sample size

The sample size for this cross-sectional study was determined using the standard formula for estimating a single population proportion. Assuming a 95% confidence level (Z = 1.96), an expected prevalence of parental vaccine hesitancy of 50% (p = 0.5), which provides the maximum sample size, and a margin of error of 5% (d = 0.05), the minimum required sample size was calculated to be 384 participants. To account for potential non-responses or incomplete questionnaires, a 20% increase was added, resulting in a final target of approximately 482 participants. Ultimately, the study included 555 participants, exceeding the minimum required number and thereby enhancing the statistical power and generalizability of the findings **(Lwanga, & Lemeshow,1991)**.

Data Collection Tool

Data were collected **using a structured, self-administered questionnaire** developed based on relevant literature and validated tools, particularly those adapted from the WHO SAGE Working Group on Vaccine Hesitancy **(WHO, 2014)**. **It consisted of three main parts:**

1. **Sociodemographic Characteristics**: This part included, items related to parents' age, gender, education level, occupation, number of children, and place of residence **(included 11 questions)**.

2. Parents' Knowledge and Perception Regarding COVID-19 and Vaccination: This part determines, parents' previous COVID-19 infection, their children's infection status, sources of information about the COVID-19 vaccine, beliefs about vaccine safety and efficacy, infection history, and attitudes toward vaccination before and after vaccine availability**(included 13 questions)** .

3. Vaccine Hesitancy and Related Behaviors: This section explored parents' willingness to vaccinate their children, reasons for acceptance or refusal, and conditions under which they might consider vaccination **(included 5 questions)** .

It also included **the Oxford COVID-19 Vaccine Hesitancy Scale**, a validated 7-item tool measuring individual hesitancy levels. **Scores of** responses were calculated on a 5-point Likert scale. Higher scores indicate a higher level of vaccine hesitancy. The scale demonstrated high internal consistency (Cronbach's alpha = 0.97) **(Ferman et al., 2020)**.

Validity and Reliability

A panel of specialists in community health nursing and pediatric nursing determined the validity of the study tool by conducting face and content validity tests on all of the instrument's items. The group of experts additionally assessed the tool's accuracy, structure, consistency, and relevancy. All requested improvements were implemented. The reliability was tested using the Cronbach's Alpha value, which was =0.97.

Pilot study

The pilot study was conducted to assess the study tool's clarity, reliability, and applicability as well as to determine the exact time needed for completing it. It was conducted on a sample of 55 parents, which represented 10% of the calculated total sample size at the aforementioned collecting setting. The participants were included in the main study sample because there were no significant changes made in the tools of data collection.

Field work

The study's fieldwork was carried out between January and June of 2022, a span of six months. Parents who visited the outpatient clinics of Al-Mabra Hospital and Zagazig University Hospitals in Zagazig City , Egypt, provided the data. Accessibility and varied levels of attendance were taken into consideration when choosing these locations, ensuring representation from a range of sociodemographic backgrounds.

In the outpatient clinics' waiting rooms, participants were approached. Eligible parents were invited to fill out the self-administered structured questionnaire following the acquisition of their written and verbal informed consent (for illiterate parents, the researchers helped them by filling out the questionnaire after listening to their responses). The researchers were available to respond to any questions without influencing answers, explain the goal of the study, and offer instructions on how to fill out the questionnaire. All participants' privacy and confidentiality were protected throughout the data collection process. Completing each questionnaire takes 15 to 20 minutes on average.

To protect participants and researchers, strict compliance with COVID-19 safety measures, including mask usage, hand cleanliness, and physical distancing, was maintained during the data collection time.

Ethical Considerations

The study proposal has been authorized by Zagazig University's Faculty of Nursing's Research Ethics Committee (REC). The researchers obtained formal consent from the directors of the previously mentioned settings before initiating data collection. Additionally, when the researchers clarified the purpose of the study, the participant parents provided their informed consent. Participant parents voluntarily and anonymously submitted the information, which was kept private and utilized exclusively for study purposes.

Statistical Analysis

Data were coded, entered, and analyzed using the Statistical Package for Social Sciences (SPSS) software version 22. Descriptive statistics were used to summarize the data: frequencies and percentages for categorical variables, and means and standard deviations (SD) for continuous variables. To examine the association between parental vaccine hesitancy and sociodemographic characteristics, Chi-square tests (χ^2) were used for categorical variables. Associations between levels of hesitancy and parents' knowledge and perception were also analyzed using Chi-square tests. A p-value < 0.05 was considered statistically significant, while $p < 0.01$ was considered highly significant. To identify predictors of vaccine

hesitancy, multiple linear regression analysis was performed. Independent variables included significant sociodemographic and perceptual factors. The strength of associations was presented through unstandardized coefficients (B), standardized coefficients (Beta), and p-values, with R^2 values indicating the proportion of variance in hesitancy explained by the model. Internal consistency of the Oxford COVID-19 Vaccine Hesitancy Scale used in the study was assessed using Cronbach's alpha test.

Results

Table (1) shows a total sample composed of 555 parents who participated in the present study. The mean age for the participants was 34.38±6.95 years, most of them were female (63.8%), nearly half of the fathers (50.7%) had a university education compared to 45.8% of the mothers, and employee was the occupation of 37.3 % of fathers. The urban area was the habitat of 51.4% of participants, and 74.6% didn't know that there was an available COVID-19 vaccine for children from 6 months to 18 years.

Table (2) portrays that 65.4% of parents were not infected with COVID-19 before, and 77.3% of them responded that their children didn't have COVID-19 before. The majority of parents (86.5 %) showed their worry about infection of their children with COVID-19 before the availability of the COVID-19 vaccine, compared to 57.3% after the availability of the vaccine. Losing a close relative or friend due to COVID-19 was the response of (37.3%), and this losing was occurred to (62.3%) before the availability of the COVID-19 vaccine. The majority of parents (84.3%) confirmed that the availability of vaccines led to a decrease in the number of cases and deaths, while 53% saw that vaccinations were effective in the prevention of COVID-19. Very dangerous was the belief of 61.1% parents about the severity of COVID-19, and 78.4 % of them reported that their belief had changed after the availability of COVID-19 vaccines.

Table (3) illustrates that media and the internet were the major sources of information about COVID-19 vaccines to the participant parents (45.9% and 25.9% respectively), 77.3% of them had given the COVID-19 vaccine, while only 17.8% of their children had given the vaccine. More than the half of parents (52%) answered that they refused to give their children COVID-19 vaccinations and the major three reseasons for refusing were insufficient studies on vaccines especially for long-term effects, fearing from the side effects of the COVID-19 vaccine, worry about deaths and morbidity after vaccination (68.4%,67.1%,43% respectively). Based on the advice of a trusted physician (54.1%) and the vaccine became essential to get to school (41.6%), which were the major conditions that the parents accepted to vaccinate their children.

Table (4) portrays that 48.6% of participant parents were unhesitant compared to 16.8% unhesitant, and 34.6% of them were unsure.

Table (5) shows asignificant and highly significant statistically relations between total hesitation score of participant parents and all items of their socio-demographic characteristics except number of children, If child suffers from chronic disease and if parents knew before that COVID -19 vaccine for children from 6months to 18 years was available ($p>0.05$).

Table (6) displays that there was a highly significant relation between the total hesitation score of participant parents and their knowledge and perception regarding COVID-19 vaccine part I ($p<0.01$). Losing a friend or relative occurred after he had received the COVID-19 vaccine was the only component that showed a non-significant relation ($p>0.05$).

Table (7) presents a multiple linear regression model analyzing the association between selected socio-demographic factors and the parental COVID-19 vaccine hesitation score. The model shows that two variables, mother's education level and prior knowledge of child vaccine availability, were statistically significant predictors of increased vaccine hesitancy (p=0.001 for both). Parents with higher educational attainment (especially mothers) were more likely to report higher hesitation. Additionally, parents who were aware of the vaccine's availability for children were paradoxically more hesitant, Although both predictors were statistically significant, the model accounted for only 7.9% of the variance in hesitation scores ($R^2 = 0.079$), suggesting that other psychological, cultural, or contextual factors not included in the model also play substantial roles.

Table 8 explores how specific reasons for vaccine refusal and conditional acceptance scenarios predict parental hesitancy. Two variables emerged as statistically significant: Belief that there have been insufficient long-term studies on the vaccine's safety and efficacy (B = 2.72, p = 0.001) and Perception that their children are not part of the at-risk group (B = 3.58, p = 0.01).

Table (1): Socio-demographic characteristics of participant parents (n=555).

Socio-demographic Characteristics	No.	%
Age of participant parent (year)		
• 20-	144	25.9
• 30-	318	57.3
• 40-	78	14.1
• >50	15	2.7
Mean ± SD	34.38±6.95	
Participant parent		
• Mothers	354	63.8
• Fathers	201	36.2
Mother education (n= 354)		
• Illiterate or Read & write	63	17.8
• Basic education	57	16.1
• Secondary	72	20.3
• University/ Post graduate	162	45.8
Mother occupation (n=354)		
• working	138	38.9
• Not Working	216	61.1
Father occupation (no= 201)		
• Farmer	63	31.3
• Worker	12	6
• Employee	75	37.3
• Craft man	15	7.4
• professional	24	12
• Other	12	6
Father education (no=201)		
• Illiterate or Read & write	39	19.4
• Basic education	24	11.9
• Secondary	36	18
• University /Post graduate	102	50.7
Residence		
• Rural	270	48.6
• Urban	285	51.4
No. of children		
• ≤3	489	88.1
• >3	66	11.9
If the child suffers from chronic disease		
• Yes	18	3.2
• No	537	96.8
If the parent knew before that COVID 19 vaccine for children from 6months to 18 years was available		
• Yes	141	25.4
• No	414	74.6

Table (2): Part I: Parents knowledge and perception regarding COVID -19 vaccine (n=555).

Items	No.	%
If participant parent has been infected with COVID 19 before?		
• Yes	147	26.5
• No	363	65.4
• May be	45	8.1
If the child has been infected with COVID - 19 before?		
• Yes	78	14.1
• No	429	77.3
• May be	48	8.6
Worry about infection of the child with COVID- 19 before availability of COVID-19 vaccine		
• Yes	480	86.5
• No	75	13.5
If parent was still worry about infection of child with COVID 19 after availability of COVID-19 vaccine		
• Yes	318	57.3
• No	237	42.7
Losing a close relative or friend due to COVID-19		
• Yes	207	37.3
• No	348	62.7
If the answer yes, when this occurred? (n=207)		
• In the beginning of COVID- 19 before availability of vaccine	129	62.3
• In one of the multiple waves of COVID-19 after the availability of vaccination	78	37.7
Losing of your friend or relative occurred after he had received COVID-19 vaccine (n=207)		
• Yes	75	36.2
• No	132	63.8
Availability of vaccines led to decrease in the number of cases and deaths?		
• Yes	468	84.3
• No	87	15.7
If the answer is No, what are the reasons of reduction in the number of cases and deaths (n=87)?		
• Weak virus	39	44.8
• Herd immunity	12	13.8
• Precautions	30	34.5
• I do not know	6	6.9
Available vaccinations are effective in prevention of COVID 19? (n=555)		
• Yes	294	53.0
• No	69	12.4
• May be	192	34.6
Your belief regarding severity of COVID- 19 (n=555)		
• Very dangerous	339	61.1
• Dangerous to some extent	201	36.2
• Not dangerous at all	15	2.7
Changing belief about the severity of COVID 19 after the availability of vaccines		
• Yes	435	78.4
• No	120	21.6

Table (3): Part II: Parents knowledge and perception regarding COVID -19 vaccine (n=555).

Items	No.	%
Source of parents information about available COVID-19 vaccine		
• Trusted physician	102	18.4
• Internet	144	25.9
• Media	255	45.9
• Friends and relatives	54	9.8
If parents had given COVID - 19 vaccine		
• Yes	429	77.3
• No	126	22.7
If the child had given COVID- 19 vaccine		
• Yes	99	17.8
• No	456	82.2
If the answer is No, do you want your child to give COVID - 19 vaccine? (n=456)		
• Yes	219	48
• No	237	52
If the answer is No, what are the reasons for not giving your child COVID-19 vaccine? (n=237)*		
• The vaccine is new and very quickly produced	93	39.2
• There have been insufficient studies on vaccines, especially for long-term effects	162	68.4
• I'm afraid of the side effects of the COVID vaccine	159	67.1
• I am worried about deaths and morbidity after vaccination	102	43.0
• Vaccine has no preventive value against COVID 19	63	26.6
• Their children are not from the risk group	81	34.8
• Their children followed the preventive instructions	48	20.3
• He or one of his children have already infected with COVID-19	42	17.7
• COVID-19 vaccine is given by injection	45	19
• The vaccine is not essential	33	13.9
Certain conditions allowing you to give your child COVID-19 vaccine*(n=555)		
• Not allowing my children to receive the vaccine under any circumstances	60	10.8
• Based on the advice of trusted physician	300	54.1
• If vaccine become essential to get school	231	41.6
• If vaccination becomes a governmental obligation	165	29.7
• If the vaccines have been approved by sufficient studies about safety and efficacy	192	34.6
• If it is proven that there is another method of vaccination other than injection	42	7.6

*: multiple response

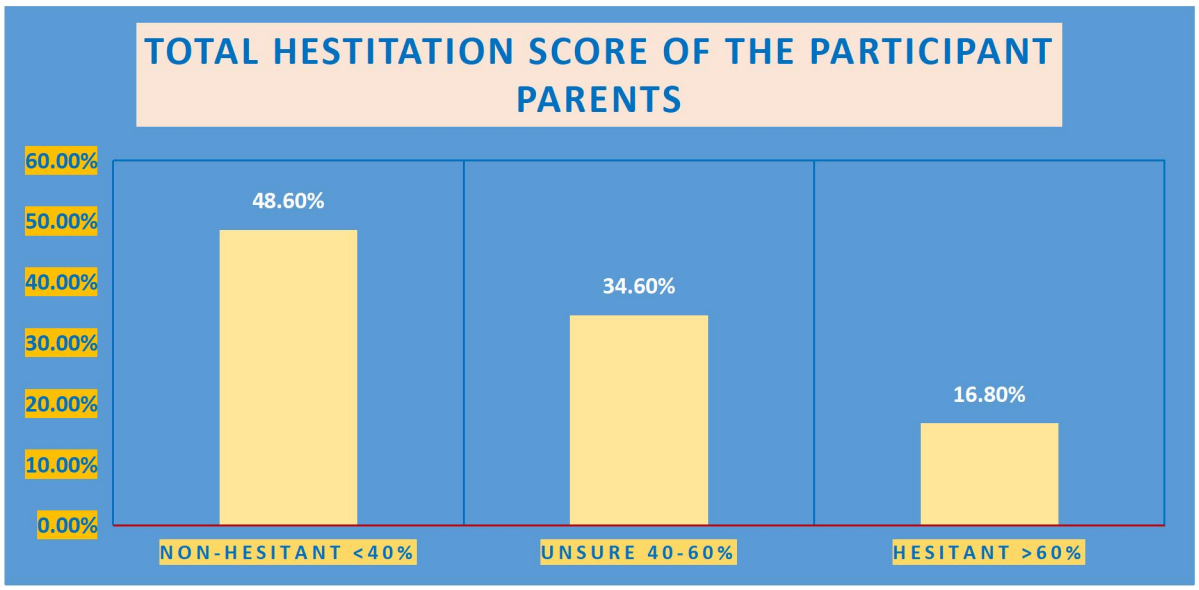

Figure (1): Total hesitation score of the participant parents.

Table (4): Relation between total hesitation score of participant parent and their socio-demographic characteristics (n=555).

Socio-demographic Characteristics	Non-hesitant <40% (n=270)		Unsure 40-60% (n=192)		Hesitant >60% (n=93)		χ 2 (p-value)
	No	%	No	%	No	%	
Age of participant parent (year)							
• 20-	51	18.9	66	34.4	27	29.0	39.379 (0.001**)
• 30-	168	62.2	105	54.7	45	48.4	
• 40-	48	17.8	18	9.4	12	12.9	
• >50	3	1.1	3	1.6	9	9.7	
Participant parent							
• Mother	162	60.0	123	64.1	69	74.2	6.0425 (0.04)*
• Father	108	40.0	69	35.9	24	25.8	
Mother education level (n= 354)	Non-hesitant <40% (n=200)		Unsure 40-60% (n=100)		Hesitant >60% (n=54)		
	No	%	No	%	No	%	
• Illiterate or Read & write	42	21.1	17	17.2	4	6.5	23.733 (0.01)*
• Basic education	42	21.1	11	10.9	4	9.7	
• Secondary	44	22.2	19	18.8	9	16.1	
• University/ Post graduate	72	35.6	53	53.1	37	67.7	
Mother occupation							
• working	69	34.4	38	37.5	31	54.8	9.4369 (0.089)*
• Not Working	131	65.6	62	62.5	23	45.2	
Father occupation (n=201)	Non-hesitant <40% (n=70)		Unsure 40-60% (n=92)		Hesitant >60% (n=39)		
	No	%	No	No	%	No	
• Farmer	28	40	24	26.1	11	28.2	27.428 (0.00**)
• Worker	4	5.7	6	6.5	2	5.1	
• Employee	20	28.6	39	42.4	16	41	
• Craft man	2	2.8	13	14.1	0	0.0	
• professional	12	17.1	4	4.3	8	20.6	
• Other	4	5.8	6	6.6	2	5.1	
Father education							
• Illiterate or Read & write	18	24.4	13	14.1	5	12.8	14.009 (0.0002**)
• Basic education	10	15.6	10	10.9	3	6.5	
• Secondary	12	16.7	24	26.6	3	6.5	
• University /Post graduate	30	43.3	45	48.4	28	74.2	
Residence							
• Rural	117	43.3	117	60.9	36	38.7	18.336 (0.000**)
• Urban	153	56.7	75	39.1	57	61.3	
No. of children							
• ≤3	240	88.9	162	84.4	87	93.5	5.338 (0.411)
• >3	30	11.1	30	15.6	6	6.5	
If child suffers from chronic disease							
• Yes	9	3.3	6	3.1	3	3.2	0.015 (0.0209)
• No	261	96.7	186	96.9	90	96.8	
If parent knew before that COVID 19 vaccine for children from 6months to 18 years was available							
• Yes	99	36.7	12	6.2	30	32.3	57.547 (0.9025)
• No	171	63.3	180	93.8	63	67.7	

χ 2 : Chi square test, non-significant(p>0.05),*: statistically significant (p<0.05),),**: statistically highly significant (p<0.01)

Table (5): Relation between total hesitation score of participant parent and their knowledge and perception regarding COVID -19 vaccine part I.

Items	Non-hesitant <40% (n=270)		Unsure 40-60% (n=192)		Hesitant >60% (n=93)		χ 2 (p-value)
	No	%	No	No	%	No	
If participant parent has been infected with COVID 19 before?							
• Yes	60	22.2	48	25.0	39	41.9	42.214 (0.000**)
• No	198	73.3	129	67.2	36	38.7	
• May be	12	4.4	15	7.8	18	19.4	
If the child has been infected with COVID 19 before?							
• Yes	33	12.2	30	15.7	15	16.1	30.35 (0.000**)
• No	222	82.2	150	78.1	57	61.3	
• May be	15	5.6	12	6.2	21	22.6	
Worry about infection of child with COVID 19 before availability of vaccine							
• Yes	216	80.0	183	95.3	81	87.1	22.547 (0.000**)
• No	54	20.0	9	4.7	12	12.9	
If parent was still worry about infection of child with COVID 19 after availability of vaccine							
• Yes	150	55.6	102	53.1	66	71.0	8.804 (0.003**)
• No	120	44.4	90	46.9	27	29.0	
Losing a close relative or friend due to COVID-19							
• Yes	93	34.4	66	34.4	48	51.6	9.79 (0.0018**)
• No	177	65.6	126	65.6	45	48.4	
If the answer yes, when this occurred? (n=207)							
• In the beginning of COVID 19 before availability of vaccine	70	75.0	31	47.6	27	56.2	13.926 (0.000**)
• In one of the multiple waves of COVID 19 after the availability of vaccination	23	25.0	35	52.4	21	43.8	
Losing of your friend or relative occurred after he had received COVID-19 vaccine (n=207)							
• Yes	31	34.4	25	38.1	18	37.5	0.431 (05115)
• No	62	65.6	41	61.9	30	62.5	
Availability of vaccines led to a decrease in the number of cases and deaths?							
• Yes	234	86.7	165	85.9	69	74.2	8.72 (0.0031**)
• No	36	13.3	27	14.1	24	25.8	
If the answer is No, what are the reasons of reduction in the number of cases and deaths (n=87)?							
• Weak virus	12	33.3	15	55.6	12	50.0	14.676 (0.0001**)
• herd immunity	9	25.0	3	11.1	0	0.0	
• precautions	15	41.7	6	22.2	9	37.5	
• I do not know	0	0.0	3	11.1	3	12.5	
Available vaccinations are effective in prevention of COVID 19							
• Yes	177	65.6	96	50.0	21	22.6	75.776 (0.000**)
• No	36	13.3	9	4.7	24	25.8	
• May be	57	21.1	87	45.3	48	51.6	
Severity of COVID 19							
• Very dangerous	177	65.6	123	64.1	39	41.9	23.002 (0.000**)
• Dangerous to some extent	90	33.3	60	31.2	51	54.8	
• Not dangerous at all	3	1.1	9	4.7	3	3.2	
Changing belief about the severity of COVID 19 after the availability of vaccines							
• Yes	201	74.4	168	87.5	66	71.0	14.907 (0.0001**)
• No	69	25.6	24	12.5	27	29.0	

χ 2 : Chi square test, non-significant(p>0.05),*: statistically significant (p<0.05),**: statistically highly significant (p<0.01)

Table (6): Relation between total hesitation score of participant parent and their knowledge and perception regarding COVID -19 vaccine part II.

Items	Non-hesitant <40% (n=270)		Unsure 40-60% (n=192)		Hesitant >60% (n=93)		χ 2 (p-value)
	No	%	No	%	No	%	
Source of information about available COVID vaccine							
• Trusted physician	72	26.7	18	9.4	12	12.9	37.681 (0.000**)
• Internet	60	22.2	57	29.7	27	29.0	
• Media	102	37.8	105	54.7	48	51.6	
• Friends and relatives	36	13.3	12	6.2	6	6.5	
Getting COVID 19 vaccine							
Yes	216	80.0	144	75.0	69	74.2	2.212 (0.1369)
No	54	20.0	48	25.0	24	25.8	
If child getting COVID 19 vaccine							
Yes	66	24.4	21	10.9	12	12.9	15.825 (0.0001**)
No	204	75.6	171	89.1	81	87.1	
If the answer is No, do you want to give your child COVID 19 vaccine (n=456)							
Yes	114	55.9	96	56.1	9	11.1	53.776 (0.000**)
No	90	44.1	75	43.9	72	88.9	

χ 2 : Chi square test, non-significant(p>0.05),**: statistically highly significant (p<0.001)

Table (7); Multiple Linear Regression Analysis of Socio-Demographic Predictors and Parental COVID-19 Vaccine Hesitation"

Predictors	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	5.991	2.362		2.536	.012	1.330	10.651
• Mother education	1.080	.383	.201	2.822	0.001**	.325	1.836
• If parent knew before that COVID 19 vaccine for children from 6 months to 18 years was available	2.776	1.010	.196	2.750	0.001**	.784	4.768

**: highly significant (p<0.001)

R-square=0.079, ANOVA: F=7.805, P<0.001

Variables entered and excluded: (age and sex of participant parent, mother occupation, father occupation, father education, residence, number of children, chronic disease).

Table (8); Multiple Linear Regression of Perceived Barriers and Conditional Acceptance Factors Associated with Parental Vaccine Hesitation"

Predicators	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	13.657	.533		25.619	.000	12.605	14.710
k28.2	2.715	.905	.233	3.001	0.001**	.929	4.501
k28.6	3.584	1.369	.203	2.617	0.01**	.881	6.287

**: highly significant (p<0.01)

R-square=0 .133, ANOVA: F= 13.140, P<0.001
k28.2= There have been insufficient studies on vaccines, especially for long-term effects
k28.6= their children are not from risk group
Variables entered and excluded: k28.1, k28.3, k28.4, k28.5, k28.7, k28.8, k28.9, k28.10, k29.1, k29.2, k29.3, k29.4, k29.5, k29.6

Discussion

During the COVID-19 epidemic, vaccine hesitancy was recognized as a public health issue and began to be defined as the acceptance and adherence of individuals to the recommended vaccine **(Troiano & Nardi 2021)**. Parents who are hesitating to give vaccinations to their children may be exhibiting worries regarding the safety and efficacy of the vaccine **(Cataldi & O'Leary 2021).** A number of social, cultural, and personal factors might influence a person's or parent's tendency to vaccinate themselves or their children **(Domek et al.,2018)**.

The current study was performed on 555 parents, and the mean age for the participants was 34.38±6.95 years. More than three-fifths of them were female, nearly half of the fathers had a university education compared to more than two-fifths of the mothers, and employment was the occupation of one-third of the fathers. More than half came from urban areas, and nearly three-quarters of them didn't know that there was an available COVID-19 vaccine for children from 6 months to 18 years.

Approximately one-fourth of parents reported being previously infected with COVID-19, while one seventh indicated that their child had contracted the virus. Notably, nearly nine-tenths of parents were worried about their child becoming infected before vaccine availability, and more than half remained concerned even after vaccines were introduced. This persistence in anxiety highlights that mere access to vaccination does not necessarily ease fears, which may stem from safety concerns and lack of trust in vaccine development processes **(Lazarus et al., 2021; Bell et al., 2020)**.

Furthermore, more than four-fifths of parents believed that vaccines contributed to reducing COVID-19 cases and deaths. However, nearly one-third remained uncertain about vaccine effectiveness. This mirrors findings from previous studies, which identified misinformation and limited understanding as major drivers of public skepticism **(Troiano & Nardi, 2021).**

Vaccine hesitancy due to misinformation appears to be a global concern, despite the uneven distribution of COVID-19

vaccinations **(World Health Organization, 2021)**. Social media is critical for communicating both accurate and inaccurate information regarding infectious diseases and vaccines **(Oyeyemi et al., 2014)**. In the present study media was the major source of information about the COVID-19 vaccine for participant parents, followed by the internet, as they were both represented by nearly three-quarters of participant parents. This disagrees with **Cascini et al. (2022)** study, who found that intensify use of social media may spread a misinformation and increase the hesitancy of the individual regarding about COVID-19 vaccine and that disagree may be related to that **Cascini et al., (2022)** study was measured the negative attitude of social media toward COVID-19 vaccination. Which confirmed by a global survey done on 166 countries it was found a link between the use of social media and vaccine hesitancy rate.

The current study revealed that more than half of the participants' parents refused to give their children COVID-19 vaccinations, and the major reasons for refusing were insufficient studies on vaccines, especially for long-term effects, fear of the side effects of the COVID-19 vaccine, and worry about deaths and morbidity after vaccination. This finding matching with Korian study done by **Kyung Cho et al., (2022)** and described the reasons of parent hesitancy against COVID-19 were protecting their children from adverse reaction (97.7%), they shave seen that preventive measures against COVID-19 enough than vaccine (33.1), protection of their children from pain of injection (27%) and to avoid disturbing daily life of their children and study time concering vaccine time (25%). That matching between the two studies could be related to the fear of parents of their young children of unknown treatment. Moreover, participant parents of the current study answered that the only exception to accepting to give their children the vaccine was the advice of a trusted physician or the vaccine became essential to attend school.

Parental vaccine hesitation was significantly higher among older participants, particularly those above 50 years of age. Additionally, about three-quarters of the hesitant group were mothers, showing a statistically significant gender difference ($p=0.04$). Interestingly, more than two-thirds of hesitant mothers had university or postgraduate education, contrasting with studies suggesting that higher education reduces vaccine hesitancy **(Freeman et al., 2021).** This could be due to higher exposure to conflicting information sources.

Urban parents were more hesitant than rural ones (61% vs. 39%, $p<0.001$), possibly due to increased exposure to social media misinformation and debates about vaccine safety (**Paul et al., 2021)**. Moreover, about three-quarters of hesitant fathers held university degrees, indicating that education alone does not guarantee vaccine acceptance. Hesitant parents were more likely to have had personal or familial COVID-19 experiences. Specifically, over two in five hesitant parents had previously been infected themselves, and over one in five were unsure if their children had been infected. This suggests that direct experience may not always increase vaccine acceptance and may contribute to skepticism, especially if recovery occurred without vaccination **(Karlsson et al., 2021)**.

Belief in vaccine effectiveness was strongly associated with lower hesitancy: two-thirds of non-hesitant parents believed the vaccine was effective, compared to only about one fifth hesitant parents. Similarly, two-thirds of the non-hesitant group viewed COVID-19 as “very dangerous,” compared to only about two fifth among the hesitant group. These findings confirm the role of risk perception and perceived severity in shaping vaccine decisions **(Betsch et al., 2018)**.

Among non-hesitant parents, more than one fourth cited trusted physicians as their primary information source, compared to only about one in eight in the hesitant group. In contrast, hesitant parents more frequently relied on media and internet sources, which are often linked to misinformation. This supports previous findings that emphasize the importance of healthcare provider guidance in promoting vaccine acceptance **(Dubé et al., 2013)**.

Furthermore, nearly nine in ten hesitant parents stated they would not allow their children to receive the vaccine, even though a majority had received it themselves. This illustrates a discrepancy between adult and child vaccine decisions, often attributed to lower perceived risk in children **(Gust et al., 2008)**.

Regression analysis identified mother's education level and prior awareness of child vaccine availability as significant predictors of hesitancy ($p=0.001$ for both). Together, they accounted for about 8% of the variation in hesitation scores. Although this indicates a statistically significant association, it also implies that over 90% of hesitancy variance stems from other unexplored factors highlighting the complex nature of vaccine decision-making **(Murphy et al., 2021).**

Parental hesitancy was most strongly predicted by two beliefs: the perception that there have been insufficient long-term studies on the vaccine and the belief that their children are not at risk. Both were statistically significant ($p<0.01$) and explained over 13% of the variation in hesitancy. These beliefs align with earlier reports identifying similar safety concerns and misperceptions of children's risk as key barriers to vaccine uptake **(Salmon et al., 2005; Opel et al., 2011).**

Conclusion

This study found a high level of parental hesitancy toward COVID-19 vaccination for children, mainly due to concerns about long-term side effects and beliefs that children are at low risk. Factors such as maternal education and prior knowledge of vaccine availability were significantly associated with hesitancy. Media and internet were major sources of information, while trust in physicians increased vaccine acceptance. Enhancing communication and providing accurate, trusted information are key to addressing parental concerns and improving vaccination rates among children.

Recommendations

Based on the study findings, the following recommendations are proposed to reduce parental hesitancy and improve COVID-19 vaccine acceptance for children:

1. Enhance Public Awareness Campaigns : Launch evidence-based educational campaigns that clearly explain the safety, efficacy, and importance of COVID-19 vaccines for children. Messaging should be culturally appropriate and address common misconceptions.

2.Strengthen Physician-Parent Communication :Equip healthcare providers with training and resources to engage in open, empathetic discussions with parents, especially those expressing doubt. Trusted physicians should proactively discuss vaccine benefits during routine visits.

3. Utilize Trusted Information Channels: As media and internet are major sources of information, authorities should collaborate with digital platforms to promote accurate vaccine information and counteract misinformation, particularly on social media.

4. Target High-Hesitancy Demographics: Focus interventions on groups identified as more hesitant, such as mothers with higher education levels and urban residents. Tailored content that acknowledges their concerns while providing scientific reassurance is essential.

5.Implement School-Based Vaccine Education : Integrate vaccine education into school programs for parents and children,

linking vaccination with school safety and continuity, especially in light of prior disruptions during the pandemic.

Limitations of the study

- **Limited Geographic Scope**:The study was conducted in a single city, which may not capture national-level variability in vaccine perceptions.we addressed it through chosen hospitals served a wide population from both urban and rural areas, increasing diversity in responses.
- **COVID-19 Context Challenges:** Data collection occurred during a dynamic period of the pandemic, which may have influenced parental opinions based on recent events or media coverage. We over come this limitation through conducting the study over a six-month period to minimize bias from short-term developments and better capture a stable perspective.

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