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ORIGINAL ARTICLE

COVID-19 vaccination rates and factors affecting vaccination in children with rheumatic disease

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ABSTRACT

Objectives: This study aimed to investigate coronavirus disease 2019 (COVID-19) vaccination rates and factors affecting vaccination in children with rheumatic diseases.

Patients and methods: This multicenter cross-sectional survey-based study was conducted between July 2022 and September 2022. Four hundred seventy-four patients (256 females, 218 males; median age: 15 years; interquartile range, 13 to 16 years) were included in the patient group, and 211 healthy children (124 females, 87 males; median age: 15 years; interquartile range, 13 to 16 years) were included in the control group. A questionnaire was administered to the parents face-to-face during routine outpatient visits.

Results: Of the patients, 220 were followed up with the diagnosis of autoinflammatory disease, 174 with juvenile idiopathic arthritis, 48 with connective tissue disease, 23 with vasculitis, eight with uveitis, and one with sarcoidosis. In the study group, 256 (54%) patients and 115 (54.5%) healthy children received at least one dose of COVID-19 vaccine. Parents' concern regarding potential side effects of the vaccine was the most common reason for COVID-19 vaccination hesitancy in both groups. The median patient age, follow-up period, colchicine treatment rates, childhood vaccination and influenza vaccination rates, median parental age, parental vaccination rate, and parental education level were higher in vaccinated patients ($p<0.05$ for all). In addition, vaccination rates were high in patients who shared their concerns about vaccination with the rheumatology team ($p<0.001$).

Conclusion: Parents' concerns about safety and side effects were found to be the most important factors affecting vaccination success. Identification of the underlying causes of parental vaccine hesitancy will facilitate the development of effective vaccination strategies for potential future outbreaks.

Keywords: Child, COVID-19, rheumatic disease, vaccination.

Despite global efforts to contain the spread of coronavirus disease-2019 (COVID-19), it has resulted in devastating numbers of confirmed cases and millions of confirmed deaths until February 2023.[1] Efforts have been undertaken in the development of medical interventions, such as vaccines and drug therapies, aimed at preventing COVID-19 disease. Based on data from the World Health Organization, approximately 13 billion doses of COVID-19 vaccines have been administered globally.[1] Observational studies have demonstrated that COVID-19 vaccines are safe and highly effective in reducing hospitalization and mortality rates.[2]

In general, COVID-19 tends to result in mild symptoms in children, and hospitalization rates are lower compared to adults.[3] COVID-19 can rarely cause a more severe disease course in children, and life-threatening complications, such as multisystem inflammatory disease, can occur, leading to rapid deterioration of the clinical

status.[4] In addition, it is known that children may spread the virus for several weeks, even in the absence of symptoms.[5] Therefore, it is important to vaccinate children both to control the outbreak by preventing the spread of infection and to ensure a milder disease course. The American Academy of Pediatrics recommends COVID-19 vaccination in children aged 12 years and older who have no contraindications for COVID-19 vaccines.[6] In Türkiye, the COVID-19 vaccination program for children aged 12 years and older was initiated in August 2021.

The incidence and course of COVID-19 in patients with rheumatic diseases are similar to the general population. However, depending on the disease and treatment-related factors, patients may have worse clinical outcomes and higher mortality compared to the general population. Thus, it is recommended that patients with rheumatic diseases receive the COVID-19 vaccination.[7,8] The aim of this study was to investigate the COVID-19 vaccination rates and factors affecting vaccination in children with rheumatic diseases.

PATIENTS AND METHODS

This cross-sectional multicenter study was conducted with at four tertiary hospital between July 2022 and September 2022. The questionnaire, designed to assess COVID-19 vaccination rates and factors that may affect vaccination success, was administered to both families of children with rheumatic diseases and healthy children during their routine outpatient visits. Four hundred seventy-four patients (256 females, 218 males; median age: 15 years; interquartile range, 13 to 16 years) with rheumatic diseases who applied to the pediatric rheumatology outpatient clinics for routine controls were included in the patient group. The control group included 211 healthy children (124 females, 87 males; median age: 15 years; interquartile range, 13 to 16 years) who attended routine outpatient visits and did not have any chronic disease. The study sample consisted of people who participated in the survey between the specified dates, and no sample size calculation was made. Since the COVID-19 vaccination program in our country only includes children aged 12 years and older, children under the age of 12 were not included. Children who received two or more doses of the vaccine were considered full-dose vaccinated.

The questionnaire used in the study comprises 25 questions aimed at determining childhood vaccination status, influenza vaccination status, COVID-19 infection and vaccination status, reasons for missed vaccine doses, and reasons for not being vaccinated. The questionnaire includes questions about the parental age, parental education level, COVID-19 vaccination status, the number of people living in the same household, and the presence of individuals with chronic diseases or over 65 years of age living in the same household. In addition, the patient group was asked questions to determine their diagnosis, follow-up period, and medications they were taking.

Statistical analysis

All statistical analyses were performed using IBM SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the distribution between groups for continuous variables. Continuous variables with a normal distribution were compared using the Student t-test, while variables without a normal distribution were compared using the Mann-Whitney U test. Categorical variables were compared using the chi-square test. Categorical variables were presented as numbers (percentages), while continuous variables were presented as median [interquartile range (IQR)] depending on their distribution. A p-value <0.05 was considered statistically significant.

RESULTS

The demographic characteristics of the study group are presented in Table 1. Of the patients, 220 (46.4%) were followed up with the diagnosis of autoinflammatory disease, 174 (36.7%) with juvenile idiopathic arthritis, 48 (10.1%) with connective tissue disease, 23 (4.9%) with vasculitis, eight (1.7%) with uveitis, and one (0.2%) with sarcoidosis. The median follow-up period was 5 (IQR: 2-9) years. The most commonly used drug was colchicine (47.7%). Conventional disease-modifying antirheumatic

drugs (DMARDs) were used in 137 (28.9%) patients, and biological DMARDs were used in 124 (26.2%) patients. In addition, 33 (7%) patients were using systemic steroids, 32 (6.8%) were using hydroxychloroquine, three (0.6%) were using Janus kinase inhibitors, and two (0.4%) were using intravenous immunoglobulin. Thirty (6.3%) patients were being followed up without treatment because the disease was in remission.

In the study, 256 (54%) patients and 115 (54.5%) healthy children received at least one dose of the COVID-19 vaccine. A total of 217 (45.7%) children in the patient group and 102 (48.3%) children in the control group were fully vaccinated. Pfizer/BioNTech vaccine was the most commonly administered vaccine in patients and healthy children (221 [86.3%] and 95 [82.6%], respectively). Sinovac/CoronaVac vaccine was administered to 34 (13.3%) patients and 20 (17.4%) healthy children. Turkovac vaccine was administered to one (0.4%) patient and none of the healthy children. In the patient and control groups, the main sources of information from which parents learned that their child should be vaccinated against COVID-19 were

Table 1. Sociodemographic characteristics of the study group

	Patient group (n=474)				Control group (n=211)			
	n	%	Median	IQR	n	%	Median	IQR
Age (year)			15	13-16			15	13-16
Sex								
Female	256	54			124	58.8		
Childhood vaccination status								
Vaccinated	437	92.2			200	94.8		
Unvaccinated	37	7.8			11	5.2		
Influenza vaccination status								
Vaccinated	91	19.2			33	15.6		
Unvaccinated	382	80.6			178	84.4		
Has your child had a COVID-19 infection?								
Yes	196	41.4			85	40.3		
No	278	58.6			126	59.7		
Has a member of your household had a COVID-19 infection?								
Yes	300	63.3			127	60.2		
No	172	36.3			83	39.3		
COVID-19 vaccination status								
Vaccinated	256	54			115	54.5		
Unvaccinated	218	46			96	45.5		
The parent who answered the questionnaire								
Mother	332	70			172	81.5		
Father	121	25.5			39	18.5		
Legal guardian	18	3.8			0	0		
Parental age (year)			42	39-46			42	39-46
Parental education level								
Primary education	222	46.8			85	40.3		
High School	157	33.1			67	31.8		
University	88	18.6			59	28		
Parental COVID-19 vaccination status								
Vaccinated	398	84			182	86.3		
Unvaccinated	73	15.4			29	13.7		
Number of people living in your house			4	4-5			4	4-5
Is there any person over 65 years of age in your household?								
Yes	37	7.8			15	7.1		
No	433	91.4			196	92.9		
Is there any person with chronic diseases in your household?								
Yes	190	40.1			90	42.7		
No	280	59.1			121	57.3		

IQR: Interquartile range; COVID-19: Coronavirus disease 2019.

physicians (44.2% and 32.7%, respectively) and media (42.5% and 51.9%, respectively). Other sources of information for the patient and control groups were electronic government applications (10.4% and 12.8%, respectively) and health professionals (2.9% and 2.6%, respectively). Twenty-three percent of parents had learned about the need for vaccination from a pediatric rheumatologist, and 43% shared their concerns about vaccination with the rheumatology team.

The rate of incomplete dose vaccination in children who received the COVID-19 vaccine was 15.2% in the patient group and 14% in the control group. The most common reason for incomplete vaccination in the patient group was the belief that one dose of vaccine was sufficient, reported by 42.1% of parents, while in the control group the most common reason was the belief that the pandemic had subsided (30.8%). Other reasons for incomplete vaccination in the patient and control groups were as follows: "side effects developed after the first dose" (7.9% and 15.4%, respectively); "had a COVID-19 infection after the first dose" (13.2% and 0%, respectively); "did not know that more than one dose of vaccine was required" (0% and 7.7%, respectively); "did not vaccinate because of a disease flare-up" (5.3% and 0%, respectively); "other" (7.7% and 5.3%, respectively).

In patients and healthy children who were not vaccinated against COVID-19, the most common reason for not vaccinating was that parents were afraid of the vaccine's side effects (57.5% and 49.5%, respectively) (Figure 1). In addition, parents most frequently did not vaccinate their children against COVID-19 due to personal opinions (65.9% in the patient group and 68.9% in the control group). Other sources of information for not vaccinating in the patient and control groups were as follows: "media (television, radio, internet)" (7.2% and 15.6%, respectively); "doctor's recommendation" (13% and 4.4%, respectively); "family members" (8.7% and 5.6%, respectively); "other patients' relatives" (1% and 3.3%, respectively); "other" (4.3% and 2.2%, respectively).

Median patient age, parental age, and follow-up time were higher in vaccinated patients compared to unvaccinated patients. The vaccination rates were found to be higher in patients who were undergoing colchicine treatment, had received childhood and influenza vaccinations, had a parent who had received the COVID-19 vaccine, and had shared their concerns about vaccination with the rheumatology team. The educational level of parents was found to be higher in vaccinated patients compared to unvaccinated patients. There were no statistically significant differences found between vaccinated and unvaccinated patients in terms of sex, diagnosis, use of medications other than colchicine, or history of prior COVID-19 infection, as presented in Table 2. In addition, no statistically significant differences were found between vaccinated and unvaccinated patients in

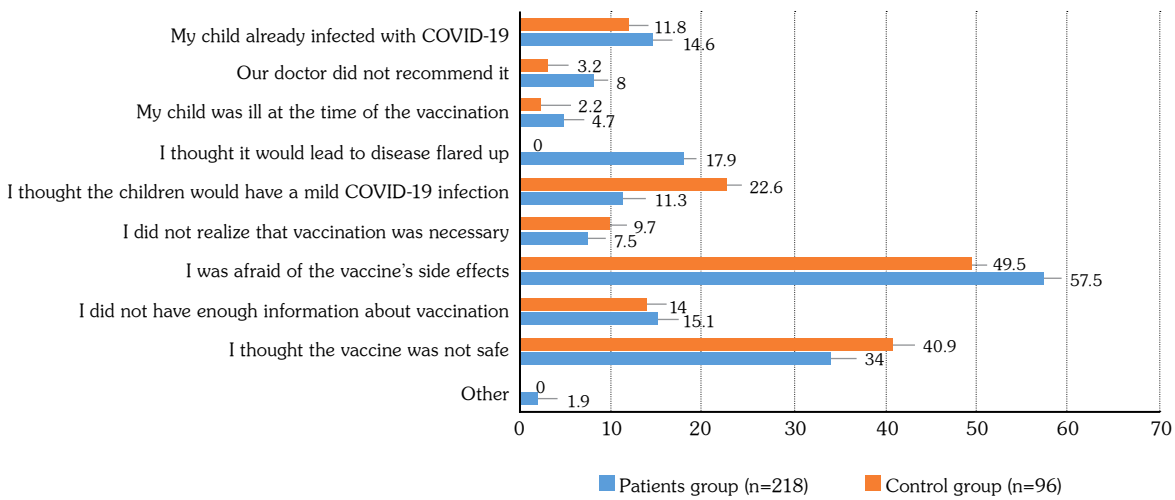

Figure 1. Reasons for not vaccinating against COVID-19.
COVID-19: Coronavirus disease 2019.

Table 2. Comparison of patient characteristics by vaccination status

	Vaccinated (n=256)				Unvaccinated (n=218)				
	n	%	Median	IQR	n	%	Median	IQR	*p*
Age (year)			15	14-17			14	13-16	**<0.001**
Sex									
Female	140	54.7			116	53.2			0.748
Diagnosis									0.316
Autoinflammatory disease	128	50			89	40.8			
Juvenile idiopathic arthritis	92	35.9			82	37.6			
Connective tissue disease	19	7.4			29	13.3			
Vasculitis	12	4.7			11	5			
Other	5	2			7	3.2			
Follow-up duration (year)			6	2.5-10			5	2-8	**0.001**
Medications									
Colchicine	134	52,3			92	42.2			**0.028**
cDMARDs	71	27.7			66	30.3			0.543
bDMARDs	70	27.3			54	24.8			0.525
Hydroxychloroquine	15	5.9			17	7.8			0.513
JAK inhibitors	2	0.8			1	0.5			0.659
Systemic steroid	14	5.5			19	8.7			0.167
IVIG	0	0			2	0.9			0.125
Without treatment	9	3.5			21	9.6			0.06
Childhood vaccination status									**<0.001**
Vaccinated	251	98			186	85.3			
Unvaccinated	5	2			32	14.7			
Influenza vaccination status									**0.036**
Vaccinated	58	22.7			33	15.1			
Unvaccinated	197	77.3			185	84.9			
Has your child had a COVID-19 infection?									0.831
Yes	107	41.8			89	40.8			
No	149	58.2			129	59.2			
Have you shared your concerns about the COVID-19 vaccine with the rheumatology team?									**<0.001**
Yes	142	57			63	29.7			
No	107	43			149	70.3			
Parental age (year)			43	40-47			42	38-45	**<0.001**
Parental education level									**0.022**
Primary education	104	41.6			118	54.4			
High School	94	37.6			63	29			
University	52	20.8			36	16.6			
Parental COVID-19 vaccination status									**0.001**
Vaccinated	241	94.9			13	5.1			
Unvaccinated	157	72.4			60	27.6			

IQR: Interquartile range; cDMARDs: Conventional disease-modifying antirheumatic drugs; bDMARDs: Biological disease-modifying antirheumatic drugs; JAK: Janus kinase; IVIG: Intravenous immunoglobulin; COVID-19: Coronavirus disease 2019.

terms of the number of persons living in the same household (4 [IQR: 4-5] in both groups, p=0.07), the presence of persons older than 65 years (22 [8.7%] *vs.* 15 [6.9%], p=0.504), the presence of persons with chronic diseases (111 [43.9%] *vs.* 79 [36.4%], p=0.10), and the history of COVID-19 infection of the same household member (164 [64.3%] *vs.* 136 [62.7%], p=0.712).

When comparing COVID-19 vaccinated patients with healthy children, it was observed that 164 (64.3%) individuals living in the same household in the patient group and 60 (52.6%) individuals in the control group had a history of COVID-19 infection, and there was a statistically significant difference (p=0.034). There were no statistically significant differences observed

Table 3. Comparison of the patient and control groups according to vaccination status

	Vaccinated								
	Patient group (n=256)				Control group (n=115)				
	n	%	Median	IQR	n	%	Median	IQR	*p*
Age (year)			15	14-17			15	14-17	0.503
Sex									0.628
Female	140	54.7			66	57.4			
Childhood vaccination status									0.707
Vaccinated	251	98			112	97.4			
Unvaccinated	5	2			3	2.6			
Influenza vaccination status									0.555
Vaccinated	58	22.7			23	20			
Unvaccinated	197	77.3			92	80			
Has your child had a COVID-19 infection?									0.992
Yes	107	41.8			48	41.7			
No	149	58.2			67	58.3			
Reasons for incomplete vaccination against COVID-19									0.342
Side effects developed after the first dose	3	7.9			2	15.4			
I thought one dose was enough	16	42.1			4	30.8			
I did not know that more than one dose of vaccine was required	0	0			1	7.7			
Had a COVID-19 infection after the first dose	5	13.2			0	0			
I thought the pandemic had eased	10	26.3			5	38.5			
Not vaccinated due to disease flare-up	2	5.3			0	0			
Other	2	5.3			1	7.7			

	Unvaccinated								
	Patient group (n=218)				Control group (n=96)				
	n	%	Median	IQR	n	%	Median	IQR	*p*
Age (year)			14	13-16			14	13-15	0.114
Sex									
Female	116	53.2			102	48.6			0.237
Childhood vaccination status									0.120
Vaccinated	186	85.3			88	91.7			
Unvaccinated	32	14.7			8	8.3			
Influenza vaccination status									0.262
Vaccinated	33	15.1			10	10.4			
Unvaccinated	185	84.9			86	89.6			
Has your child had a COVID-19 infection?									0.704
Yes	89	40.8			37	38.5			
No	129	59.2			59	61.5			
Reasons for incomplete vaccination against COVID-19									
I did not realize that vaccination was necessary	16				9				0.532
I did not have enough information about vaccination	32				13				0.800
I was afraid of the vaccine's side effects	122				46				0.191
I thought the vaccine was not safe	72				38				0.248
I was not afraid as I thought the children would have a mild COVID-19 infection	24				21				**0.011**
I thought it would lead to disease flared up	38								0.357
My child was ill at the time of the vaccination	10				2				0.120
Our doctor did not recommend it	17				3				0.509
My child already infected with COVID-19	31				11				0.317
Other	4				0				
What sources of information led you to decide not to vaccinate?									0.423
My personal opinion	137	65.9			62	68.9			
Doctor's recommendation	27	13			4	4.4			
Family members	18	8.7			5	5.6			
Other patients' relatives	2	1			3	3.3			
Media (television, radio, internet)	15	7.2			14	15.6			
Other	9	4.3			2	2.2			

IQR: Interquartile range; COVID-19: Coronavirus disease 2019.

between the groups in terms of sex, median patient age, childhood immunization status, influenza vaccination status, COVID-19 infection rates, and reasons for incomplete dose vaccination, as presented in Table 3. There were no significant differences found between the vaccinated patients and the control group in the rates of incomplete dose vaccination (39 [15.2%] *vs.* 16 [14%], p=0.358), the most preferred vaccine (Pfizer/BioNTech) (217 [86.5%] *vs.* 95 [82.6%], p=0.473), median parental age (42 [IQR: 40-47] in both groups, p=0.844), parental education level (primary education 104 [41.6%] *vs.* 45 [39.1%], high school 94 [37.6%] *vs.* 35 [30.4%], and university 52 [20.8%] *vs.* 35 [30.4%]; p=0.115), and parental COVID-19 vaccination status (241 [94.9%] *vs.* 105 [91.3%], p=0.20). Additionally, no statistically significant differences were found between the vaccinated patients and the control group in terms of the number of persons living in the same household (4 [IQR: 4-5] in both groups, p=0.347), the presence of persons older than 65 years (22 [8.7%] *vs.* 7 [6.1%], p=0.395), and the presence of persons with chronic diseases in the same household (111 [43.9%] *vs.* 53 [46.1%], p=0.692).

Comparing patients and healthy children who were unvaccinated against COVID-19, the rate of parents who did not vaccinate their children because they thought that the children would have a mild COVID-19 infection was significantly higher in the control group. For other reasons for not vaccinating, there was no significant difference between the groups. There were no significant differences were found between the groups in terms of sex, median patient age, childhood vaccination status, influenza vaccination status, COVID-19 infection rates, and sources of information that led parents to decide not to vaccinate their children against COVID-19 (Table 3). No significant difference was found between the patient group and the control group in terms of parental age (median 42 [38-45] *vs.* 41 [39-45], p=0.679), educational level (primary education 118 [54.4%]*vs.* 40 [41.7%], high school 63 [29%] *vs.* 32 [33.3%], and university 36 [16.6%] *vs.* 24 [25%]; p=0.082), and parental COVID-19 vaccination status (157 [72.4%] *vs.* 77 [80.2%], p=0.140). In addition, no statistically significant differences were found between the unvaccinated patients and the control group in terms of the number of persons living in the same household (4 [IQR: 4-5] in both groups, p=0.477), the presence of persons older than 65 years (15 [6.9%] *vs.* 8 [8.3%], p=0.657), the presence of persons with chronic diseases in the same household (79 [36.4%] *vs.* 37 [38.5%], p=0.718), and the history of COVID-19 infection in the same household (136 [62.7%] *vs.* 67 [69.8%], p=0.224].

DISCUSSION

In this study, the rate of at least one dose of vaccination in children with rheumatic disease was 54%, and the rate of two or more doses was 45.7%. The most common reasons reported by parents for not vaccinating their children against COVID-19 in the study were fear of vaccine side effects and the belief that vaccines were not safe.

Varying rates of vaccine acceptance in children with rheumatic diseases have been reported in studies published at different times during the COVID-19 pandemic. Akgün et al.,[9] who aimed to assess parents' attitudes, concerns, and knowledge about the COVID-19 vaccine before the vaccination program started, reported that 41.8% of parents agreed to have their children vaccinated against COVID-19, 45.8% were undecided, and 12.4% refused vaccination. According to the study conducted by Yıldız et al.[10] in November 2021, which included 160 pediatric rheumatology patients, the parent-reported COVID-19 vaccination rate was 75%. In another study that investigated the efficacy of the BNT162b2 mRNA (messenger ribonucleic acid) COVID-19 vaccine among adolescents with juvenile-onset inflammatory rheumatic diseases, it was reported that the vaccination rate was 72.5% among 1,639 patients, and the rate of at least two doses of the vaccine was 61.6%.[11] In our study, which was conducted one year after the initiation of the vaccination program, the vaccination rate was 54.2%. The low rates of COVID-19 vaccination in our study suggest that despite the widespread use of vaccines worldwide and the known efficacy and safety profiles of these vaccines, there is still a significant level of opposition or reluctance among patients and parents toward vaccination.

Vaccination rates were higher in patients who were undergoing colchicine treatment. No difference was found for other drugs. This may be because colchicine treatment is considered more reliable regarding vaccine efficacy and side effects compared to immunomodulatory treatments such as steroids, biological DMARDs, and conventional DMARDs. A survey study conducted on 226 patients with rheumatic diseases who were receiving biological drugs and DMARD treatment reported that pain at the injection site was the most common side effect experienced by patients (72.6%), while only two (0.9%) patients developed severe side effects. The study also found that there was no significant difference in the frequency of side effects among patients using biological therapy, colchicine, and DMARDs.[12] Similarly, in another study that evaluated 91 patients with rheumatic diseases who were receiving immunomodulatory therapy, it was observed that the vast majority of patients (96.7%) experienced minimal or no side effects after receiving the COVID-19 vaccine. Additionally, 91% of patients remained stable after receiving the second dose of the vaccine without requiring any changes in their ongoing treatment regimen.[13] Immunomodulatory therapies, such as conventional DMARDs and biological DMARDs, have been reported to have no impact on the effectiveness of the COVID-19 vaccine.[11] These findings suggest that the COVID-19 vaccine is both effective and safe for patients receiving immunomodulatory drug therapy.

A comprehensive meta-analysis, which involved a large cohort of 68,327 participants across 16 countries and territories, found that parents' or guardians' willingness to have COVID-19 vaccination for themselves was an important independent factor associated with their willingness to have their children vaccinated. It has also been reported that participants with high school or lower education levels were less likely to accept the COVID-19 vaccination for their children compared to those with university or higher education.[14] In our study, similar to the findings in the literature, it was observed that parental education level and COVID-19 vaccination rates were higher in the patient group that received COVID-19 vaccination. Previous studies have shown that individuals who have previously received seasonal influenza vaccination exhibit a greater inclination towards accepting COVID-19 vaccination for themselves and their children,[15-17] and routine childhood vaccination behaviors are a determining factor for COVID-19 vaccine acceptance.[18] Our study results are consistent with previous findings, as we found that patients who received the COVID-19 vaccination also had higher rates of influenza and routine childhood vaccinations. This finding suggests that attitudes towards influenza and routine childhood vaccinations are important factors that contribute to COVID-19 vaccine acceptance among parents.

Previous studies have shown that the main reason for vaccine hesitancy or refusal in patients with rheumatic diseases is fear of vaccine side effects.[10,19,20] Consistent with the existing literature, our study found that the most common reasons for refusal of the COVID-19 vaccination among patients and healthy controls were concerns about vaccine side effects and safety. Du et al.[21] conducted a systematic review and meta-analysis and found that the risk of adverse reactions, such as injection site pain, swelling, and fever, varied depending on the type of vaccination administered to children aged 3 to 17 years. However, no significant difference was found for severe and life-threatening adverse reactions compared to the control group. According to the study by Haslak et al.,[22] which included 246 adolescents and young adults with rheumatic diseases, the most common adverse events reported after COVID-19 vaccination were fatigue (27.6%), headache (17.9%), myalgia (15.4%), arthralgia (15.4%), and fever (14.2%). Only three participants experienced serious adverse events that required hospitalization. Arslanoglu Aydin et al.[19] also reported that the most frequently observed side effects among 228 children with rheumatic diseases following vaccination were mild reactions, such as pain at the injection site, fatigue, myalgia, and fever. However, no severe adverse reactions, such as anaphylactic shock, myocarditis, or death, were reported. A previous study of pediatric patients with inflammatory rheumatic diseases reported that the most commonly reported adverse events following vaccination were injection site pain (59%), fatigue (54%), and headache (39%). Notably, no cases of severe adverse events, such as anaphylaxis

or myocarditis, were reported.[23] Comparable to healthy children, children with rheumatic diseases typically experience mild adverse effects following vaccination. The low incidence of severe and life-threatening adverse events suggests that COVID-19 vaccines have an acceptable safety profile in rheumatology patients.

Sources of information affecting parents' decision to have their children vaccinated against COVID-19 were evaluated, and the rate of parents who received information from the doctor was 44.2% in the patient group. The rate of those who shared their concerns about the vaccine with the rheumatology team was 43%, and vaccination rates were higher in these patients. In a multicenter survey study conducted by Yi et al.,[24] which included 1,022 patients with rheumatic disease, it was reported that 41.5% of patients received information about vaccines from their doctor, while the vaccination rate was 31.7%. In a survey of 7,005 adults with rheumatic diseases from 102 countries, 97.9% of 574 individuals who were hesitant or undecided about the COVID-19 vaccine reported that doctors or other health professionals were the most important sources of information that could influence their decision to get vaccinated.[25] The support of rheumatologists plays an important role in increasing the willingness of individuals to be vaccinated.[26] The American College of Rheumatology has issued a strong recommendation for rheumatology healthcare providers to assess the vaccination status of their patients for COVID-19.[8] In our study, nearly half of the participants (42.5% in the patient group and 51.9% in the control group) reported that the source of information about vaccination was the media. Notably, our study revealed that parents' decision-making processes regarding vaccination were based to a significant extent on their personal opinions. Since media such as television, radio, and the internet may provide negative information about vaccination, it may increase the reluctance of families to vaccinate. Providing accurate and reliable information about vaccines from trusted sources can help alleviate parents' concerns and increase vaccination rates. In addition, the active participation of physicians in the vaccination process and their efforts to inform patients, and parents can positively impact vaccination success.

The main limitation of our study is that the information obtained is reliant on self-reported data from families, as it is a questionnaire-based study. We were unable to review the immunization records of the participants and their children, which resulted in our inability to validate vaccination rates.

In conclusion, parental concerns regarding the safety and potential side effects of COVID-19 vaccination were significant barriers to vaccination success in pediatric patients with rheumatic diseases. Understanding the causes of parental vaccine hesitancy can help develop effective vaccination strategies for future outbreaks.

Ethics Committee Approval: The study protocol was approved by the Dokuz Eylul University Non-Interventional Research Ethics Committee (date: 14.09.2022, no: 2022/29-21). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from the parents of the patients.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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