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Original article

# COVID-19 vaccine hesitancy among parents of children with systemic lupus erythematosus

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**Background:** Coronavirus disease 2019 (COVID-19) vaccination remains an essential strategy for reducing disease burden. Specific guidelines for vaccinating children with systemic lupus erythematosus (SLE) are currently unavailable, highlighting the gap in tailored recommendations for this population.

**Purpose:** This study aimed to estimate parental intention to vaccinate children with SLE against COVID-19 and identify factors associated with this intention. It also explored parents' attitudes toward the vaccine.

**Methods:** Seventy-four parents of patients aged 5–21 years who were diagnosed with SLE before 18 years of age were surveyed regarding their willingness to further vaccinate their children with SLE against COVID-19. The parents were categorized into vaccine acceptance (VA) and vaccine hesitancy (VH) groups and completed a validated 6-item questionnaire designed to gauge their attitudes toward the vaccine. Vaccine hesitancy scale (VHS) scores were calculated with higher scores indicating increased VH. The adjusted odds ratios (aOR) (95% confidence interval [CI]) for VA-associated factors were determined using multivariate analysis.

**Results:** Twenty-five parents (33.8%) were diagnosed with VH. Compared with the VH group, the VA group showed a higher frequency of previous COVID-19 vaccine uptake, completed immunization in children, and parental willingness to be vaccinated themselves. Children were older in the VA versus VH group. The mean total VHS score was significantly higher in the VH versus VA group. In a multivariate model of factors differing significantly between the VA and VH groups, parental willingness to vaccinate themselves (aOR, 5.0; 95% CI, 1.2–20.4), patient age (aOR, 1.4; 95% CI, 1.1–1.9), and VHS score on vaccine efficacy belief (aOR, 0.1 [0.0–0.5]) were significantly associated with VA.

**Conclusion:** A significant proportion of parents were hesitant to vaccinate their children with SLE against COVID-19. These insights underscore the importance of developing targeted educational interventions to address specific parental concerns and improve vaccine uptake in children with SLE.

**Key words:** Child, COVID-19, COVID-19 vaccines, Systemic lupus erythematosus, Vaccination hesitancy

## Key message

**Question:** What is the acceptance rate for coronavirus disease 2019 vaccination among parents of children with systemic lupus erythematosus (SLE)?

**Finding:** One-third of parents were hesitant to vaccinate their child. Parental willingness to vaccinate themselves, older patient age, and belief in the vaccine's potency were associated with vaccine acceptance.

**Meaning:** These findings highlight the need for targeted interventions to improve vaccine acceptance among parents of children with SLE.

## Introduction

The world has witnessed the transition of the coronavirus disease 2019 (COVID-19) from a pandemic to an endemic state as the virus responsible for COVID-19, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), continues to evolve.[1] COVID-19 vaccination is a crucial strategy to curb the incidence of COVID-19.[2] Messenger RNA-based COVID-19 vaccines are authorized for use in children aged 6 months to 18 years.[3] The national immunization program (NIP) against COVID-19 of Thailand recommended a messenger RNA-based vaccine for children aged 12–18 years old in August 2021 and for children aged 5–12 years old in February 2022.[4] As the protection from COVID-19 vaccines diminishes over time, the Centers for Disease Control and Prevention has recommended that everyone aged 5 years and older receive one

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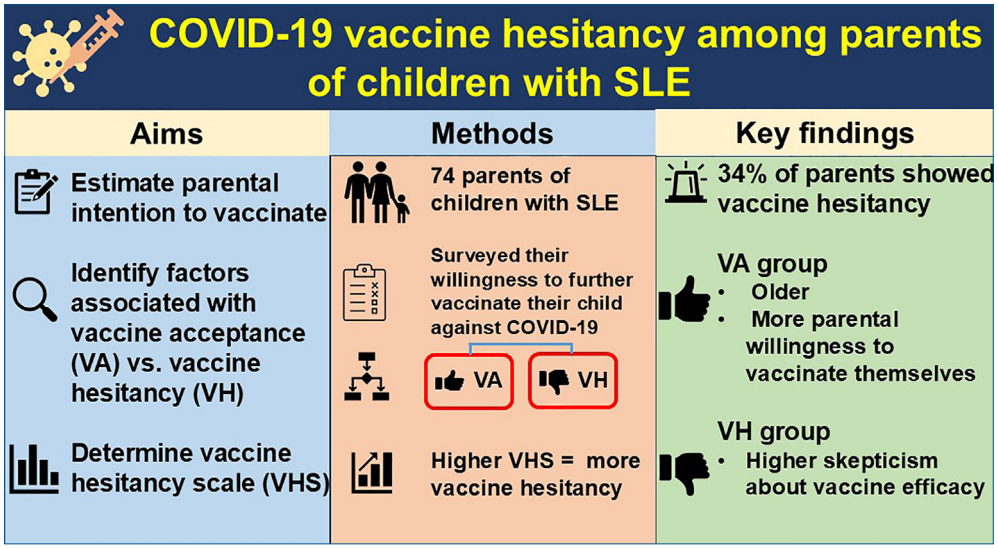


**Graphical abstract.** Overview of study design and results. COVID-19, coronavirus disease 2019; SLE, systemic lupus erythematosus.

dose of an updated COVID-19 vaccine to safeguard against serious illness.[5] Additional doses of the COVID-19 vaccine are advised for individuals who are moderately or severely immunocompromised.[6]

Systemic lupus erythematosus (SLE) is an autoimmune inflammatory rheumatic disease (AIIRD) resulting from immune dysregulation.[7] The therapeutic management of SLE often includes immunosuppressive agents, such as steroids. Both immune dysregulation and the use of immunosuppressive therapies heighten susceptibility to SARS-CoV-2 infection and increase the risk of severe COVID-19 manifestations.[8,9] While SLE typically occurs in women of childbearing age, children account for 15-20% of patients.[10] Pediatric SLE typically has a more aggressive disease course than adult-onset SLE or other pediatric AIIRDs, with severe complications such lupus nephritis being particularly common.[10,11] Lupus nephritis significantly impacts disease prognosis and often necessitates intensive immunosuppressive therapy, which could influence parental attitudes toward COVID-19 vaccination.

Despite the critical role of vaccination in the COVID-19 pandemic response, the pooled vaccine acceptance (VA) rate in adults with SLE was 67%.[12] Vaccine hesitancy (VH) defined as the refusal of vaccines or a delay in acceptance despite the availability of immunization services remains a significant challenge, especially in children with pre-existing illnesses.[13,14] Parental acceptance of COVID-19 vaccination for healthy children ranges from 40%–60%, with even lower acceptance rates reported for children with chronic illnesses.[5,14-15] Concerns about vaccine safety, potential interactions with immunosuppressive therapies, and overall health vulnerabilities are prominent drivers of VH among parents of children with chronic medical conditions.[16-19] A recent survey of parents of children with AIIRDs reported a VA rate of 41.8%, highlighting significant VH in this population.[16]

Although pediatric SLE is classified under AIIRDs, its systemic nature, aggressive course, and higher reliance on immunosuppressive therapy distinguish it from other pediatric AIIRDs.[10] These characteristics may amplify parental concerns about COVID-19 vaccination, making it essential to explore whether the factors influencing VH in SLE differ from those affecting parents of children with other chronic conditions or AIIRDs.

Our study aimed to estimate parental intentions to vaccinate their children with SLE against COVID-19 and to investigate the predictors of their decisions. We also explored parental attitudes and concerns regarding COVID-19 vaccination, recognizing the importance of tailoring vaccination strategies to address the specific vulnerabilities of children with SLE. By examining these factors, our research seeks to fill an important gap and provide insights to inform targeted strategies for improving vaccine uptake in this high-risk population.

## Methods

This cross-sectional survey was conducted at a tertiary center in Thailand from May to August 2023. Parents of patients aged 5 to 21 years who had been diagnosed with SLE before turning 18 were eligible. Potential respondents were identified in the outpatient clinic while their child awaited a scheduled consultation. Informed consent was obtained and only one parent per patient completed the survey. This study was approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand (No.0817/65).

### 1. Parental characteristics

Parental sociodemographic details including age, educational status, and family income were collected. Educational status was classified as below college or some college or higher. Family income was classified as above or below the national average. Data on parental comorbidities, previous COVID-19 vaccine uptake, side effects of COVID-19 vaccine, and history of COVID-19 infection were also collected.

### 2. Patient characteristics

Clinical characteristics of children with SLE were gathered using standardized formats to assess disease status, treatment-related variables, previous COVID-19 vaccine uptake, side effects of COVID-19 vaccine, and history of COVID-19 infection. Their immunization cards were reviewed. Lupus nephritis was diagnosed if hematuria, proteinuria, or decreased kidney function was present. Advanced chronic kidney disease was defined as an estimated glomerular filtration rate below 60 mL/min/1.73 $m^2$.[20,21] Disease duration was defined as the time from diagnosis to survey. The accumulated damage index since the onset of SLE was determined using the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index (SLICC/ACR DI).[22]

### 3. Survey administration

The survey comprised 2 main sections.

#### 1) Parental willingness to vaccinate their child

This section assessed parental willingness to allow their child with SLE to receive the COVID-19 booster vaccine. Parents answered the question, "Are you willing to further vaccinate your child with SLE against COVID-19?" with response options of "yes," "no," and "unsure." Parents were classified as VA or VH based on their willingness to vaccinate their child. Participants who answered "unsure" were categorized as VH. The same question was asked to evaluate their willingness to vaccinate themselves.

#### 2) Parental attitudes toward COVID-19 vaccination

This section utilized a previously validated questionnaire to examine parental attitudes toward COVID-19 vaccination for their child. The questionnaire included 6 items addressing the importance of the vaccine for their child's health and the community, belief in vaccine efficacy, perceived reliability of COVID-19 vaccine information from healthcare providers, adherence to healthcare professional recommendations regarding the COVID-19 vaccine, and concerns regarding side effects. Responses were measured on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree.' Vaccine hesitancy scale (VHS) scores were calculated, with higher scores indicating increased VH.

### 4. Statistical analysis

Data analysis was performed using Stata v14 (StataCorp, College Station, TX, USA), with *P* values of <0.05 considered statistically significant. Descriptive data are reported as mean±standard deviation for quantitative variables and proportion (%) for categorical variables. Participant and patient characteristics were compared between the VA and VH groups using t tests for quantitative variables and chi-square or Fisher exact tests for categorical variables.

Variables significantly different between VA and VH were included in a multivariable logistic regression model to determine potential factors associated with the willingness to vaccinate their child against COVID-19. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) were calculated.

The reliability of the 6-item questionnaire for assessing parental attitudes towards COVID-19 vaccination was evaluated using Cronbach alpha coefficient. The questionnaire demonstrated good reliability, with a Cronbach coefficient alpha of 0.8577.

## Results

### 1. Parental characteristics

Out of 75 eligible parents, 74 (59 mothers, 79.7%) completed the questionnaire. Parental characteristics are detailed in Table 1. The average age was 46.0±8.9 years. Eighteen parents (24.3%) had at least one comorbidity, and 49 (66.2%) had a history of COVID-19 infection. Five parents (6.8%) had never received a COVID-19 vaccine. Fifty-five parents (79.7%) reported side effects from previous COVID-19 vaccine. Regarding their willingness to be further vaccinated against COVID-19 for themselves, 51 parents (68.9%) were willing, 12 (16.2%) were unsure, and 11 (14.9%) were unwilling.

### 2. Patient characteristics

The characteristics of the 74 children with SLE (61 female, 82.4%) are provided in Table 1. The average age was 16.1±3.2 years. The average disease duration was 59.6±40.2 months, and lupus nephritis was diagnosed in 58 patients (78.4%). Two patients (2.7%) had advanced chronic kidney disease.

Seventy children (94.6%) had received at least one dose of COVID-19 vaccine and 50 of them (71.4%) experienced some side effects. Sixty-seven children (90.5%) had completed the NIP. Forty (54.2%) had a history of COVID-19 infection.

### 3. Parental willingness to booster their child with SLE against COVID-19

Based on parental willingness to allow their child with SLE to receive the COVID-19 booster vaccine, 49 parents (66.2%) were classified as VA, while 25 parents (33.8%) were VH, including 10 who answered "unsure" and 15 who answered "unwilling." Fig. 1 presents parental willingness to vaccinate their child, categorized by the roles of fathers and mothers. No significant differences in willingness were observed between mothers and fathers (*P*=1.00).

Table 1 displays the comparison between VA and VH

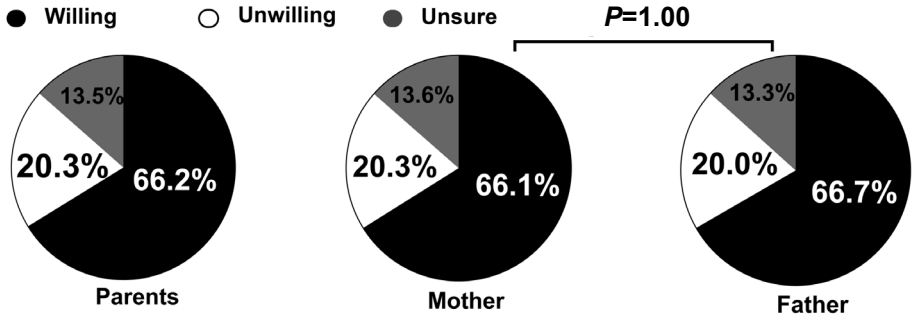


**Fig. 1.** Parental willingness to vaccinate their child with SLE against COVID-19 categorized by the roles of fathers and mothers. SLE, systemic lupus erythematosus; COVID-19, coronavirus disease 2019.

**Table 1. Characteristics of children with SLE and their parents based on parental willingness to vaccinate their child against COVID-19**

| Characteristic | Total (n = 74) | Vaccine acceptance (n=49) | Vaccine hesitancy (n=25) | *P* value |
|---|---|---|---|---|
| Parents | | | | |
| Mother | 59 (79.7) | 39 (79.6) | 20 (80.0) | 1.00 |
| Age (yr) | 46.0±8.9 | 46.6±9.1 | 45.0±8.5 | 0.48 |
| Comorbidities | 18 (24.3) | 14 (28.6) | 4 (16.0) | 0.27 |
| Some college or higher | 32 (43.2) | 21 (42.9) | 11 (44.0) | 0.93 |
| Family monthly income above national average | 42 (56.8) | 30 (61.2) | 12 (48.0) | 0.28 |
| Vaccination against influenza | 45 (60.8) | 26 (53.1) | 19 (76) | 0.06 |
| History of COVID-19 infection | 49 (66.2) | 30 (61.2) | 19 (76.0) | 0.20 |
| Previous COVID-19 vaccine uptake | 69 (93.2) | 45 (91.8) | 24 (96.0) | 0.66 |
| Side effects of COVID-19 vaccine | 55/69 (79.7) | 35/45 (77.8) | 20/24 (83.3) | 0.76 |
| Willingness to further vaccinate themselves against COVID-19 | 51 (68.9) | 41 (83.7) | 10 (40.0) | **<0.001** |
| Respondents' children | | | | |
| Female | 61 (82.4) | 41 (83.7) | 20 (80.0) | 0.69 |
| Age (yr) | 16.1±3.2 | 16.8±3.0 | 14.9±3.4 | 0.02 |
| Disease duration (mo) | 59.6±40.2 | 64.6±38.8 | 49.8±41.9 | 0.14 |
| SLICC/ACR damage index | 0.7±0.1 | 0.8±0.2 | 0.5±0.2 | 0.42 |
| Lupus nephritis | 58 (78.4) | 39 (79.6) | 19 (76.0) | 0.72 |
| Proliferative lupus nephritis | 35 (60.3) | 25 (51.0) | 10 (40.0) | 0.37 |
| Advanced CKD | 2 (2.7) | 1 (2.0) | 1 (4.0) | 1.00 |
| Immunosuppressive therapy | | | | |
| Prednisolone dose (mg/day) | 11.0±1.4 | 9.6±1.5 | 13.7±2.8 | 0.17 |
| Hydroxychloroquine | 67 (90.5) | 43 (87.8) | 24 (96.0) | 0.41 |
| Cyclophosphamide | 6 (8.1) | 4 (8.2) | 2 (8.0) | 1.00 |
| Mycophenolate mofetil | 32 (43.2) | 21 (42.9) | 11 (44.0) | 0.93 |
| Vaccination against influenza | 67 (90.5) | 43 (87.8) | 24 (96.0) | 0.41 |
| Completed NIP | 67 (90.5) | 47 (95.9) | 20 (80.0) | **0.03** |
| Previous COVID-19 vaccine uptake | 70 (94.6) | 49 (100) | 21 (84.0) | **0.01** |
| Side effects of COVID-19 vaccine | 50/70 (71.4) | 34/49 (69.4) | 16/21 (76.2) | 0.77 |
| History of COVID-19 infection | 40 (54.1) | 27 (55.1) | 13 (52.0) | 0.80 |

Values are presented as number (%) or mean±standard deviation.
SLE, systemic lupus erythematosus; COVID-19, coronavirus disease 2019; SLICC/ACR, Systemic Lupus International Collaborating Clinics/American College of Rheumatology; CKD, chronic kidney disease; NIP, National Immunization Program.
Boldface indicates a statistically significant difference with *P*<0.05.

and their respective children. Previous uptake of COVID-19 vaccine was higher in children of VA than VH (100 % vs. 84%, *P*=0.01) (Table 1). Willingness to receive the COVID-19 vaccine for themselves was higher among VA than VH (84% vs. 40%, *P*<0.001). The children of VA were older than those of VH (16.8±3.0 years vs. 14.9±3.4 years, *P*=0.02), and more children of VA had completed the NIP compared to VH children (95.9% vs. 80.0%, *P*=0.03). SLICC/ACR DI scores, previous uptake of influenza vaccine, and immunosuppressive therapy were comparable in children of both groups.

### 4. Parental attitudes toward COVID-19 vaccine

The results showed that 75.7% of parents agreed that the COVID-19 vaccine was important for their child's health, 69.0% agreed with the protection potency of the COVID-19 vaccine, 78.4% agreed that vaccinating their child with the COVID-19 vaccine was important for the health of others in the community, 83.5% believed that the information from the healthcare provider about a future COVID-19 vaccine was reliable and trustworthy, 86.5% would follow the healthcare provider's recommendations regarding a future COVID-19 vaccine, and 63.5% were concerned about the potential serious adverse effects of a future COVID-19 vaccine (Fig. 2A).

Based on the parental response to the questionnaires, VHS scores were calculated. The total and itemized VHS scores are shown in Fig. 2B. The average total VHS score in VH was significantly higher than in VA (2.8±0.6 vs. 2.3±0.4, *P*<0.001). When examining the itemized VHS scores, VH had significantly higher scores than VA in most items, including the importance of COVID-19 vaccine for their children, the protection potency of the COVID-19 vaccine, importance of vaccination for the health of others

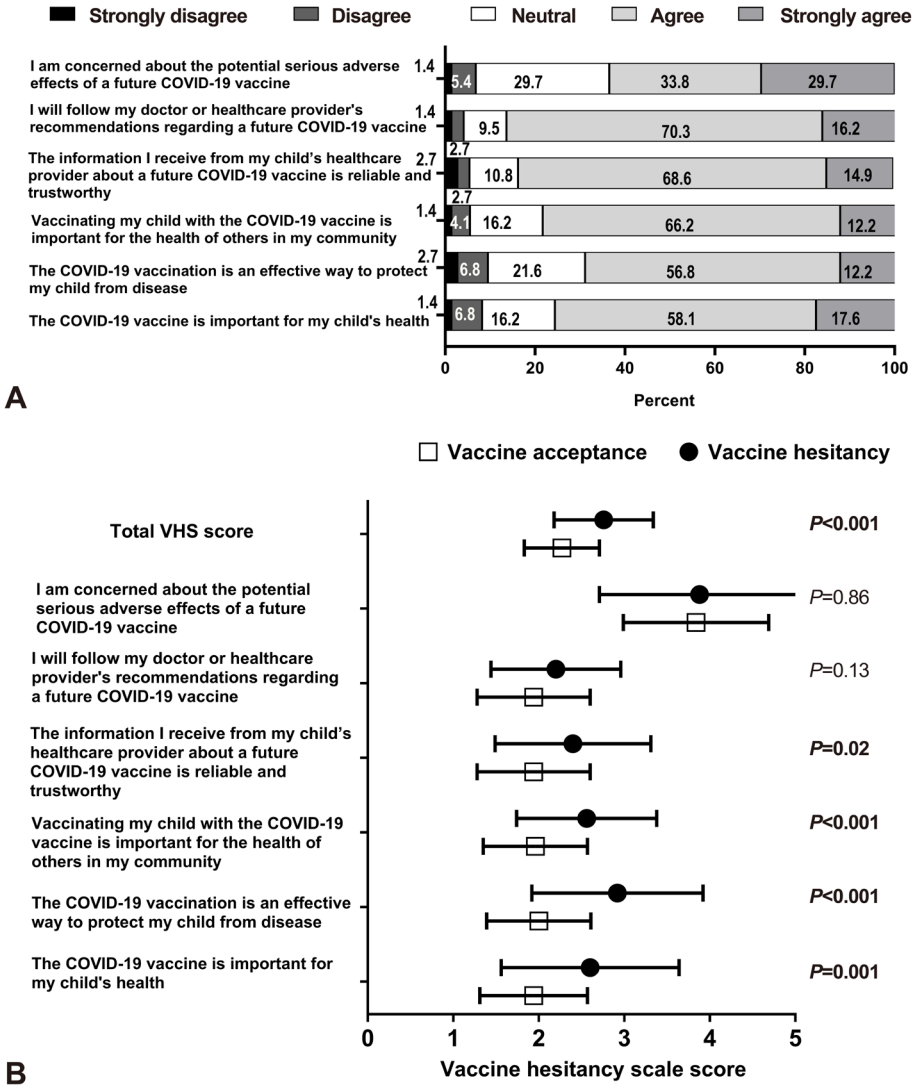


**Fig. 2.** Hesitancy toward COVID-19 vaccination among parents of children with SLE (A) and comparison of vaccine hesitancy scale (VHS) scores between parents with vaccine acceptance and vaccine hesitancy (B). COVID-19, coronavirus disease 2019; SLE, systemic lupus erythematosus.

in the community, and reliable and trustworthy of the information from their healthcare provider about a future COVID-19 vaccine. Although the scores for adherence to healthcare provider's recommendations regarding a future COVID-19 vaccine and concerns about the potential serious adverse effects of a future COVID-19 vaccine were higher in VH, the differences did not reach statistical significance.

**5. Factors associated with parental willingness to vaccinate their child with SLE against COVID-19**

Factors found significantly different between VA and VH were included in multivariate analysis (Fig. 3). These factors were parental willingness to vaccinate themselves, patient age, completed NIP, and 4 items from the parental attitude assessment namely, the importance of COVID-19 vaccine for their child's health, disbelief in the protection potency of the COVID-19 vaccine, importance of vaccination for the health of others in the community, and reliability and trustworthy of the information from their healthcare provider. Previous uptake of COVID-19 vaccine in the patients was omitted from the multivariable model as the variable was a perfect predictor of the outcome.

In the multivariate model, 3 factors were significantly associated with parental willingness to vaccinate their child against COVID-19 (Fig. 3). Parental willingness to vaccinate their child increased by 5-fold if parents were willing to vaccinate themselves (aOR, 5.0; 95% CI, 1.2–20.4; *P*=0.02). The likelihood of parental willingness to vaccinate their child with SLE increased by 40% per 1 year increase in patients' age (aOR, 1.4; 95% CI, 1.1–1.9; *P*=0.01). Disbelief in the protection potency of the COVID-19 vaccine negatively influenced parental willingness to vaccinate their child. Every 1-point increase in the VHS score in the item measuring concerns about COVID-19 vaccine efficacy decreased the likelihood of parental willingness to vaccinate their child by 10 times (aOR, 0.1; 95% CI, 0.0–0.5; *P*=0.008).

## Discussion

Vaccination remains a cornerstone in preventing COVID-19 infection for both healthy children and those with medical conditions, such as SLE.[23] As of 2023, 95% of children with SLE in the study had received at least one dose of the COVID-19 vaccine. Despite this high uptake of the initial dose, only two-thirds of parents expressed willingness to continue vaccinating their child with SLE against COVID-19. VA is fluid and can change over time.[24] The decline in VA observed after a nationwide vaccination drive among the parents in our study mirrors trends seen in the general population.[25,26] In this study, we found that parents with VA were more willing to vaccinate themselves, their children were older, and they were more confident in vaccine efficacy.

The decision to vaccinate children with SLE relies heavily on parental discretion due to limited guidelines for this specific population.[27,28] Studies have shown that factors including sociodemographic characteristics, attitudes toward vaccination, perceived susceptibility to COVID-19, vaccine knowledge, and pre-existing medical conditions of their child influence parental vaccination intentions.[12] VH among parents varies by their children's medical conditions.[16-19] Willingness to vaccinate against COVID-19 is 33% for children with kidney disease or hypertension,[18] 57% for children with cancer,[19] and 42%–75% for children with AIIRD.[16,17]

Our study indicates that parental willingness to vaccinate their children with SLE against COVID-19 is moderate and influenced by many factors. Identifying these factors can help optimize vaccine uptake in this specific pop-

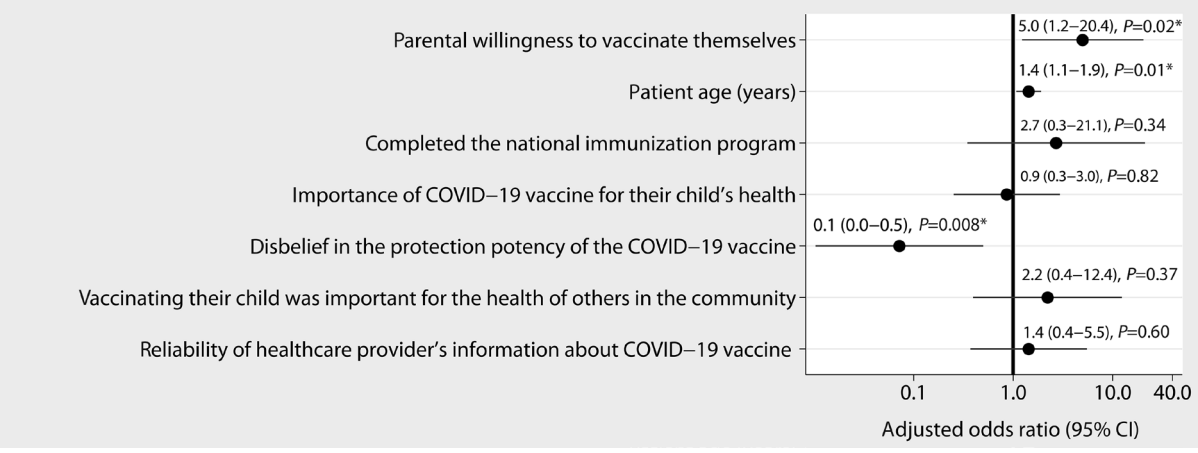


**Fig. 3.** A multivariate logistic regression model for factors associated with parental willingness to vaccinate their child with SLE against COVID-19. COVID-19, coronavirus disease 2019; SLE, systemic lupus erythematosus. CI, confidence interval.

ulation. Our study found that parents who were willing to vaccinate themselves against COVID-19 were significantly more likely to vaccinate their children. According to the Theory of Planned Behavior, attitudes toward a behavior significantly predicts intentions to perform that behavior.[29] Attitude was the strongest predictor of vaccination intention, and intention was the strongest predictor of vaccination uptake.[29]

Parents with positive attitudes toward vaccines generally trust their safety and efficacy. Prior COVID-19 infection led to disbelief in vaccine efficacy among adults with SLE.[30] The multivariable logistic regression demonstrated that disbelief in vaccine efficacy was found to be a factor associated with VH in our study. Half of the patients in our study had prior COVID-19 infection despite a high vaccination rate. The belief in natural immunity after COVID-19 infection might reduce the perceived need for further vaccination. Only two-thirds of parents in our study believed in the protective efficacy of the COVID-19 vaccine. The likelihood of parental willingness to vaccinate their child increased with the child's age. The novel mRNA vaccine platform and its initial approval for older children might have caused apprehensions about vaccinating younger children due to perceived novelty and potential side effects.[4] These concerns may impact intentions to vaccinate younger children compared to older ones.

Sociodemographic characteristics such as parental education levels and family income have shown mixed effects on willingness to vaccinate.[31] For example, a study on parents of children with AIIRD found no differences in education and employment status between vaccinated and unvaccinated groups, although family income was higher among the vaccinated.[17] In our study, education and family income were comparable between VA and VH groups.

Healthcare professionals play a crucial role in vaccine guidance. Our study showed that both VA and VH parents of children with SLE expressed high levels of adherence to healthcare professionals' recommendations. A previous study found that over half of SLE patients with VH would likely get vaccinated if assured by their doctor, highlighting the importance of professional guidance over advice from friends or family.[30]

This study has several limitations. First, the prevalence of VH can be influenced by study design. Willingness to vaccinate is typically higher in studies where data are collected through questionnaires in clinical settings compared to online surveys, potentially leading to overestimation of willingness in our study.[31] However, the inclusion of an "unsure" response option could decrease the parental intention to accept a COVID-19 vaccine for their children.[31]

Second, our study population was exclusively Asian. Studies show that VA is influenced by geographical region, with higher acceptance rates in Asia.[31] Therefore, our findings may not be generalizable to other populations.

Third, although a complete NIP was not independently associated with parental VA in our study, our data revealed significant differences in both previous COVID-19 vaccine uptake and the rates of complete NIP in children of VA versus VH parents (100% vs. 84% and 95.9% vs. 80.0%, respectively). These findings suggest that parental VH may stem from both general VH and specific concerns about the COVID-19 vaccine. However, the relative contributions of these factors could not be determined definitively from our study.

Fourth, while the rates of previous COVID-19 vaccine uptake were significantly higher in children of VA compared to VH, our study does not clearly establish the relationship between parental willingness to vaccinate their child with SLE against COVID-19 and the actual booster vaccination rates. As a result, the extent to which parental willingness influences actual vaccination rates, including booster vaccination, in children with SLE remains unclear and further research is required.

In conclusion, this study provides valuable insights into the willingness and attitudes of parents of children with SLE toward COVID-19 vaccination. While the majority are willing to vaccinate their children, a significant portion remain hesitant. Our findings highlight the need for targeted interventions to address VH in this vulnerable population. Establishing formal guidelines for COVID-19 vaccination in pediatric SLE patients could further support informed decision-making among parents.

## Footnotes

Conflicts of interest: No potential conflict of interest relevant to this article was reported.

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