The Evaluation of COVID-19 Vaccination Rates, Side Effects and Perspectives of Rheumatic Patients, A Cross-sectional Study in a University-based Teaching Hospital, Thailand

Nantawan Sutto[1], Chutimon Sinnok[1], Noppanan Vihokpaibul[1], Intira Intra[1], Yama Muneechai[1], Sakchai Chaiyamahapurk[2], Bodin Buttham[3], Patapong Towiwat[3]

[1]Medical student, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand.
[2]Department of Community Medicine, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand.
[3]Department of Medicine, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand.

Abstract

Objective
This study aims to investigate the vaccination rate among rheumatic patients, the incidence of COVID-19 infection in the vaccinated and unvaccinated groups, the post-vaccination side effects, and opinions regarding the decision whether to vaccinate against COVID-19 infection.
Methods
A cross-sectional study was conducted on rheumatic patients at the Department of Medicine, Naresuan University Hospital, Thailand. A questionnaire was developed for the survey.
Results
The total number of rheumatic patients was 384, and 363 individuals (94.5%) received the COVID-19 vaccine. Among those who received at least 2 doses, the COVID-19 infection rate was 44.69%. In the groups of patients who received either one dose or no vaccine, the COVID-19 infection rate was 57.69%. Eighty-three patients (22.86%) had adverse effects, predominantly fever and fatigue. Among those receiving vaccination, 71.34% decided to protect themselves from COVID-19 infection, while among those who decided not to get vaccinated, 85.71% opted out because of vaccine side effects. Regarding the relationship between factors leading rheumatic patients to receive the COVID-19 vaccine, no statistically significant factors were found (p-value < 0.05).
Conclusion
The majority of rheumatic patients received the COVID-19 vaccine. Patients who received the full dosage of the vaccine had a lower infection rate. Most side effects were mild. Patients mainly chose to vaccinate themselves for self-protection against infection, while others chose not to vaccinate due to concern about vaccine side effects. Furthermore, no factors correlated with COVID-19 vaccination among rheumatic patients.

Keywords: COVID-19 infection, Immunosuppressants, Rheumatic diseases, Side effect, Vaccination

Corresponding author: Patapong Towiwat, Department of Internal Medicine, Naresuan University, Phitsanulok, Thailand, 65000, Phone +66-89-107-7503, Fax +66-55-96-5105, puidulian@gmail.com

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Introduction

The global impact of the COVID-19 pandemic up to May 15, 2023, had been staggering, with over 667 million reported cases and 6.7 million fatalities worldwide. Thailand, like many other nations, faced its initial cases in January 2020, accumulating 3,998 infections by November of that year. Subsequently, the government implemented control measures that effectively managed the initial wave.

Thailand's vaccination program began in February 2021. Data from the Ministry of Public Health (MOPH) Immunization Center (up to March 10, 2023) revealed a nationwide total of 146,758,556 doses administered across all 77 provinces. This comprehensive vaccination campaign encompassed individuals receiving their first dose up to their sixth, with coverage rates of 82.8%, 77.8%, 39.3%, 9.4%, 1.5%, and 0.1%, respectively. When focusing on Phitsanulok province during the same period, the vaccination coverage rates for each dose were 75.9%, 73.3%, 37.3%, 9.0%, 1.9%, and 0.1%, respectively.[1]

Rheumatic and autoimmune diseases affect joints, muscles, and connective tissues, present unique challenges during the COVID-19 pandemic. A study had shown that individuals with rheumatoid arthritis, systemic lupus erythematosus (SLE) and psoriasis had a higher mortality risk if they contact COVID-19 compared to those without these conditions.[2] Consequently, COVID-19 vaccination is recommended for rheumatic patients.[2,3] While various nations had examined vaccination rates, post-vaccination infection rates, and adverse effects in the general population.[4-7] Many studies that were studied about flare up of rheumatic disease, safety and perception or decision-making about COVID-19 vaccination in rheumatic patients.[8-16]

While some studies in Thailand had explored the adverse effects of COVID-19 vaccines in rheumatic patients, none has comprehensively addressed vaccination rates or COVID-19 infection rates in this specific patient demographic data.[17] Therefore, this study aims to investigate vaccination rates, post-vaccination infection rates, adverse effects, and patient perspectives on decision-making regarding COVID-19 vaccination at Naresuan University Hospital.

Methods and Materials

Study designs

This study employed a quantitative approach through a cross-sectional study. The study targets rheumatic patients underwent treatment at the out-patient department of internal medicine in Naresuan University Hospital during November to December 2023, comprising a total of 384 patients.

Inclusion criteria were rheumatic patients who had received treatment or follow-up care at the out-patient department of medicine in Naresuan University Hospital, patients ≥ 20 years old and patients who voluntarily provide written informed consent for data collection.

Exclusion criteria were patients who were unable to read and understand Thai language and patients with communication difficulties.

COVID-19 infection was defined based on patients' self-reports from the questionnaire.

Data Collection Method

Data was collected through the administration of a questionnaire. The researcher provided the questionnaire to each patient, with an estimated completion time of 10 minutes. Patients were instructed that the questionnaire could not be taken home to complete. Upon completion, participants returned the questionnaire by placing it into a securely closed reception box located at out-patient examination room.

Data Collection Tools

Questionnaire

The questionnaire was developed through a comprehensive literature review and consultation with two rheumatologists.

The questionnaire covered the following topics: general information including age, gender, educational level, occupation, underlying of rheumatic diseases, and comorbidities. History related to COVID-19 including any history of COVID-19 infection, vaccination status, dosage received, and any adverse effects experienced after vaccination and perspectives on decision-making regarding COVID-19 vaccination.

Statistical Analysis

The data was analyzed by Stata version 18, with a significant level set at less than 0.05. General information including gender, age, education level, occupation, type of rheumatic diseases, and comorbidities was analyzed using descriptive statistics. This involved presenting frequency distributions and percentages to describe the population characteristics. Percentages were utilized to depict opinions on COVID-19 vaccination and any associated side effects. Additionally, percentages were used to determine vaccination rates and COVID-19 infection rates. Furthermore, factors influencing the decision to receive COVID-19 vaccination were explored through univariable logistic regression analysis.

Research Ethics

Approval for the research was obtained from the Human Research Ethics Review Committee at Naresuan University to ensure adherence to ethical standards (P3-0086/2566).

Results

This study analyzed data collected from 384 rheumatic patients aged 20 years and older. The age range for the majority of participants was 46-70 years. The mean age was 55.92(± 16.90) years. Among the participants, 291 were female (75.78%) and 93 were male (24.22%). Approximately half of the participants (46.61%) had attained a bachelor's degree or higher education level. Regarding employment, 154 (40.10%), were either unemployed or retired. Meanwhile, 92 participants (23.96%) were identified as employees, merchants, or business owners. Among the rheumatic patients participated, 156 (40.63%) had comorbidities, with allergies and kidney disease being the most common. On the other hand, 145 participants (37.76%) did not report any comorbidities apart from rheumatic diseases. Rheumatoid arthritis was identified as the most prevalent type of underlying of rheumatic diseases, affecting 143 participants (37.24%), followed by SLE with 130 participants (33.85%), as illustrated in Table 1.

After surveying the perspectives of 363 participants (94.53%) who adjusted to receive vaccination, the top three reasons were protecting themselves from infection (71.34%), the government's vaccination campaign (19.28%) and receiving advice from healthcare (17.63%). Vaccination was not received in 21 participants, with majority reasons being concern of adverse effects (85.71%), as illustrated in Table 2.

Table 1 The baseline demographic and clinical characteristics of the study population

Characteristic	N (%)
Age	
20-45 years old	105 (27.34)
46-70 years old	206 (53.65)
≥ 71 years old	73 (19.01)
Sex	
Male	93 (24.22)
Female	291 (75.78)
Education level	
None	8 (2.08)
Primary school	121 (31.51)
Secondary school	76 (19.79)
Bachelor's degree and above	179 (46.61)
Occupation	
Student	13 (3.39)
Government officer/medical personnel	77 (20.05)
Employee/business	92 (23.96)
Agriculture	48 (12.50)
Retire/unemployed	154 (40.10)
Comorbidity/Underlying disease	
None	145 (37.76)
Hypertension	128 (33.33)
Diabetes mellitus	38 (9.89)
Ischemic heart disease	9 (2.34)
Stroke	4 (1.04)
Others	156 (40.63)
Type of underlying of rheumatic disease	
Rheumatoid arthritis	143 (37.24)
Systemic lupus erythematosus	130 (33.85)
Spondyloarthropathy	7 (1.82)
Vasculitis	11 (2.86)
Systemic sclerosis	11 (2.86)
Myositis	1 (0.26)
Immunoglobulin G4 disease	1 (0.26)
Gout	39 (10.15)
Osteoarthritis	39 (10.15)
Others	16 (4.17)

Table 2 The reasons for taking or not taking the vaccine

Taking the COVID-19[+] vaccination		Not taking the COVID-19[+] vaccination	
Reasons	**N (%)**	**Reasons**	**N (%)**
Protecting themselves from COVID-19[+]	259 (71.34)	Concern of side effect	18 (85.71)
Protecting other persons from COVID-19[+]	50 (13.77)	Vaccine ineffective	3 (14.28)
Helping to end pandemic	26 (7.61)	Risk of COVID-19[+] is low	0
Advised by healthcare professional	64 (17.63)	Painful injection	0
Government promotion	70 (19.28)	Concern of rheumatic disease flare-up	3 (14.28)
Advised by family member or friend	25 (6.88)	Decrease vaccine effectiveness due to immunosuppressants	0
Peer pressure	15 (4.13)	Not enough data on vaccine	0
Requested by company	27 (7.43)	Would like to consult a medical professional before vaccine	0
Others	15 (4.13)	Others	4 (19.04)

[+]COVID-19: coronavirus disease 2019

Eighty-three of vaccinated participants (22.87%) reported side effects, of which the common side effects were fever, fatigue, injected site pain/swelling and headache, respectively. Other side effects as illustrated in Table 3.

Table 3 The side effects experienced from COVID -19 vaccine in 83 patients

Side effects	N (%)
Injected site pain/swelling	39 (10.74)
Fatigue	46 (12.67)
Headache	23 (6.33)
Fever	83 (22.86)
Allergic reaction	11 (3.03)
Chest pain/discomfort	2 (0.55)
Arthralgia	17 (4.68)
Lymphadenopathy	1 (0.27)
Flare-up of rheumatic disease	8 (2.20)
Others	1 (0.27)

The rates of COVID-19 infection among the study participants were analyzed. Among participants who received at least two doses of vaccination, a total of 160 individuals (44.69%) were infected with COVID-19, whereas among participants who received only one dose of vaccination or none, 15 individuals (57.69%) were infected with COVID-19 (*p*-value 0.199), as illustrated in Table 4. However, among the unvaccinated patients with rheumatic disease, only one developed a COVID-19 infection.

Table 4 The rate of COVID-19 infection in vaccinated and unvaccinated patients

The number of dosages of COVID-19[+] vaccination	Infected patients N (%)	Non-infected patients N (%)	*p*-value
≥ 2 doses	160 (44.69)	198 (55.31)	0.199[*]
At least 1 dose or no vaccination	15 (57.69)	11 (42.31)	

[*]Exact test was compared between vaccine variable and infection with COVID-19 variable.
[+]COVID-19: coronavirus disease 2019

In Table 5 showed that across all age groups, genders, educational level and occupation, the vaccination for two doses or more is over 90%. When considering comorbidities, it is observed that among patients with two or more comorbidities, the vaccination rate is 90.91%, which is lower than those with one or no comorbidity. Furthermore, when considering underlying of rheumatic diseases separately, patients with all types of rheumatic diseases have vaccination rate of over 85%. Upon analyzing the factors influencing vaccination decisions using univariable analysis, which include age, gender, educational level, occupation, comorbidities, and type of rheumatic diseases were not significantly associated with COVID-19 vaccination decisions.

The survey regarding perspectives of patients on receiving the next dose of vaccination, if the government had offer free vaccination for one dose per year, 209 patients (54.42%) would have expressed an intention not to receive the vaccine, while 175 patients (45.58%) indicated their intention to continue receiving vaccination.

Table 5 Univariable analysis on factors associated with full dose vaccination

Factors	N (%)	Vaccination (n%)		Univariable analysis	
		≥ 2 dose vaccination	No vaccination or 1 dose	Odd ratio (95% CI[+])	*p*-value
Age					
20-45 years old	105 (27.34)	99 (94.29)	6 (5.71)	ref	
46-70 years old	206 (53.65)	192 (93.20)	14 (6.80)	0.83 (0.30-2.22)	0.713
71 years old and above	73 (19.01)	67 (91.78)	6 (8.28)	0.67 (0.20-2.18)	0.514
Sex					

Female	291 (75.78)	272 (93.47)	19 (6.53)	ref	
Male	93 (24.22)	86 (92.47)	7 (7.53)	0.85 (0.34-2.11)	0.739
Education level					
None or primary school	129 (33.59)	118 (91.47)	11 (8.53)	ref	
Secondary school	76 (19.79)	73 (96.05)	3 (3.95)	2.26 (0.61-8.40)	0.220
Bachelor's degree and above	179 (46.61)	167 (93.29)	12 (6.71)	1.29 (0.55-3.03)	0.549
Occupation					
Retire/unemployed	154 (40.10)	142 (92.21)	12 (7.79)	ref	
Student	13 (3.39)	13 (100)	0	NA*	
Government officer /medical personnel	77 (20.05)	71 (92.20)	6 (7.80)	1 (0.36-2.77)	1.000
Employee/business	92 (23.96)	85 (92.39)	7 (7.61)	1.02 (0.38-2.70)	0.958
Agriculture	48 (12.50)	47 (97.92)	1 (2.08)	3.97 (0.50-31.36)	0.191
Comorbidity					
None	145 (37.76)	137 (95.17)	8 (4.83)	ref	
1 comorbidity	162 (42.18)	151 (93.21)	11 (6.79)	0.97 (0.34-2.76)	0.964
≥ 2 comorbidities	77 (20.05)	70 (90.91)	7 (9.09)	0.60 (0.19-1.85)	0.375
Type of rheumatic disease					
Rheumatoid arthritis	143 (37.24)	134 (93.71)	9 (6.29)	ref	
Systemic lupus erythematosus	130 (33.85)	123 (94.62)	7 (5.38)	1.18 (0.42-3.26)	0.750
Spondyloarthropathy	7 (1.82)	6 (85.74)	1 (14.26)	0.40 (0.04-3.71)	0.423
Vasculitis	11 (2.86)	10 (90.91)	1 (9.09)	0.67 (0.07-5.84)	0.718
Systemic sclerosis	11 (2.86)	11 (100)	0	NA	
Myositis	1 (0.26)	1 (100)	0	NA	
Immunoglobulin G4 disease	1 (0.26)	1 (100)	0	NA	
Gout	39 (10.15)	35 (89.74)	4 (10.26)	0.58 (0.17-2.02)	0.399
Osteoarthritis	39 (10.15)	34 (87.18)	5 (12.82)	0.45 (0.14-1.45)	0.184
Others	16 (4.17)	15 (93.75)	1 (6.25)	1.00 (0.11-8.50)	0.995

+ CI: confidence interval; * NA: data not available

Discussions

This study investigates the rate of COVID-19 vaccination among patients with rheumatic diseases, the incidence of COVID-19 infections in vaccinated and unvaccinated rheumatic patients, side effects, and patient perspectives on vaccination. It was observed that the vaccination rate among patients with rheumatic disease is 93.22%. The most common side effect following vaccination was fever in 22.86% of cases, with fatigue being the second most common. Among patients who received at least two doses of the vaccine, the incidence of COVID-19 infection was 44.69%. The survey of patient perspectives on vaccination revealed that most patients opted for vaccination to protect themselves from infection, while those who did not receive the vaccine were concerned about potential side effects.

COVID-19 began its outbreak in December 2019, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. Both COVID-19 and rheumatoid arthritis share similar immuno-inflammatory pathways, notably involving interleukin (IL)-6, which plays a significant pathological role in both diseases.[18] In rheumatoid arthritis, IL-6 responds to joint damage, while in COVID-19, it is associated with exacerbation of lung disease.[18] Other than that, COVID-19 infection can trigger flare-ups of SLE, but another review has found that rheumatic diseases do not increase the risk of COVID-19 infection or severity, although they may lead to complications after infection.[19]

In Thailand, measures had been implemented to vaccinate the population against COVID-19 to prevent infection and reduce disease severity.[20] According to data from the MOPH Immunization Center, by March 10, 2023, 77.8% of the population had received at least two doses of the vaccine. This data demonstrates a higher vaccination rate among rheumatic patients compared to the general

population. This discrepancy may reflect increased health awareness among rheumatic patients or could be due to the timing of data collection, which might influence vaccination decisions.

The vaccination rate observed in this study is higher than that reported in previous research, which indicated a 30% vaccination rate among rheumatic patients, with the primary reason for not being vaccinated being concern of side effects.[5] This variation might be due to differences in the study periods, resulting in differing vaccination rates.

The study found that patients with rheumatic disease who received at least two doses of the vaccine had a lower incidence of COVID-19 compared to those who received only one dose or none. This finding aligns with previous studies, suggesting that receiving at least two doses provides better immune response than a single dose.[16,21] Side effects reported after vaccination were consistent with other studies, indicating that most side effects are mild and have minimal impact on rheumatic disease symptoms.[5,6,15]

Moreover, a study demonstrated that there was no significant increase in breakthrough COVID-19 infections between patients with SLE and those with non-rheumatic autoimmune diseases or healthy participants; however, there was a significant increase in breakthrough COVID-19 infections between patients with SLE and those with rheumatic autoimmune diseases.[22]

When examining factors associated with COVID-19 vaccination using univariable analysis, there were no significant associations with age, gender, education, occupation, underlying health conditions, or type of rheumatic diseases, as none of these factors showed statistical significance (p-value < 0.05). This contrasts with previous studies[5] that identified factors related to vaccination decisions, such as male gender and having hypertension. The discrepancy may be due to the small sample size in this study, which could have affected the detection of significant factors.

Although the COVID-19 outbreak has subsided, Thailand continues to recommend COVID-19 vaccination alongside annual influenza vaccination to reduce disease severity and mortality.[23] This study may provide insights for healthcare providers managing rheumatic patients, particularly in addressing concerns about COVID-19 vaccine side effects and guiding vaccination recommendations.

Moreover, this study has a few strengths. The first, the side effects occurring after receiving the COVID-19 vaccine were explored in this study. Although our hypothesis, comorbidity that is not rheumatic diseases had affected to the decision for receiving for the first and the next time of prescription of COVID-19 vaccination. However, there is no significance and association between comorbidity and the decision of receiving COVID-19 vaccination in our study. The result showed that the questionnaire covers the topic in comorbid diseases. Finally, our study cover almost common rheumatic diseases in real practice. These findings may assist in making informed decisions about future patient care. However, our study had some limitations. Firstly, this study focused only six closed questions of limitation factors in this study that may influence the limited decision to receive the vaccine. Therefore, if the included patients had other reasons, they could not express their other reasons. The second, this study was a cross-sectional study. Therefore, our results may change over time with evolving public health policies. Secondary, this cross-sectional study used a questionnaire that did not assess relapse of autoimmune disease or disease-related adverse events; therefore, these outcomes could not be evaluated from the available data. Finally, the rheumatic patients who were included in this study were followed in the tertiary care. This limitation does not cover in the primary or secondary care hospitals. These limitations ought to correct in the future study for COVID-19 vaccination.

Conclusion

This study found that most patients with rheumatic diseases, primarily with rheumatoid arthritis, have a higher COVID-19 vaccination rate compared to the general population. Patients who received at least two doses had a lower infection rate than those who received only one dose or no vaccine. Side effects in post-vaccination were generally mild, including fever, fatigue, local pain or swelling. Most patients chose to be vaccinated to protect themselves from infection, while concerns about vaccine side effects led others to refrain from vaccination.

LIST OF ABBREVIATIONS

CI: Confidence interval
COVID-19: Coronavirus disease 2019
IL: Interleukin
MOPH: Ministry of Public Health
NA: Data not available
SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2
SLE: Systemic lupus erythematosus

Disclosure

Conflict of Interests:

The authors declare that they have no any conflict of interests.

Data Availability and Material:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Statement:

The study protocol was approved by the Institutional Review Board and Ethics Committee, in accordance with the Declaration of Helsinki of Naresuan University Hospital (IRB No. P3-0086/2566).

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Author Contribution:

BB and SC designed the study protocol. NT, CS, NV, II and YM a had collected data of Naresuan University Hospital. Data analysis was performed by SC. The manuscript with critically intellectual content was revised by PT. The final version of manuscript was accepted and approved by all authors.

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Consent to participate:

Informed consent was attained from all rheumatic patients.

Ethical Responsibilities of Authors:

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References

1. Department of Disease Control, Ministry of Public Health. COVID-19 Vaccination Progress Report [Internet]. Nonthaburi: Ministry of Public Health; 2023 [cited 2026 Feb 14]. Available from: https://ddc.moph.go.th/vaccine-covid19/getFiles/9/1678949996284.pdf
2. Landewe RBM, Kroon FPB, Alunno A, et al. EULAR recommendations for the management and vaccination of people with rheumatic and musculoskeletal diseases in the context of SARS-CoV-2: the November 2021 update. *Ann Rheum Dis*. Dec 2022;81(12):1628-1639. doi:10.1136/annrheumdis-2021-222006
3. Curtis JR, Johnson SR, Anthony DD, et al. American College of Rheumatology Guidance for COVID-19 Vaccination in Patients With Rheumatic and Musculoskeletal Diseases: Version 5. *Arthritis & Rheumatology*. 2023;75(1):E1-E16. doi:https://doi.org/10.1002/art.42372
4. Molteni E, Canas LS, Klaser K, et al. Post-vaccination infection rates and modification of COVID-19 symptoms in vaccinated UK school-aged children and adolescents: A prospective longitudinal cohort study. *Lancet Reg Health Eur*. Aug 2022;19:100429. doi:10.1016/j.lanepe.2022.100429
5. Iba T, Levy JH. Thrombosis and thrombocytopenia in COVID-19 and after COVID-19 vaccination. *Trends Cardiovasc Med*. Jul 2022;32(5):249-256. doi:10.1016/j.tcm.2022.02.008
6. Guo Y, Cao XS, Yang HT, Zhou MG, Yu B. Global incidence pattern and factors associated with common cutaneous reactions related to COVID-19 vaccination of 2.55 million participants in real-world settings: A systematic review and meta-analysis. *J Glob Health*. Feb 10 2023;13:06008. doi:10.7189/jogh.13.06008
7. SeyedAlinaghi S, Karimi A, Pashaei Z, et al. Safety and Adverse Events Related to COVID-19 mRNA Vaccines; a Systematic Review. *Arch Acad Emerg Med*. 2022;10(1):e41. doi:10.22037/aaem.v10i1.1597
8. Yao R, Liang R, Lu J, et al. Impact of coronavirus disease 2019 on psoriatic arthritis: A multiregional observational study. *Rheumatology & Autoimmunity*. 2024; 4:226-234. doi:10.1002/rai2.12134234
9. Alshukairi AN, Al-Omari A, Albeity A, et al. COVID-19 breakthrough infections in rheumatic diseases patients after vaccination. *Journal of Infection and Public Health*. 2022/06/01/ 2022;15(6):685-688. doi:https://doi.org/10.1016/j.jiph.2022.05.005
10. Peng D, Kelly A, Brady B, Faasse K, El-Haddad C, Frade S. Perspectives and experiences of COVID-19 vaccination in people with autoimmune and inflammatory rheumatic disease. *Patient Education and Counseling*. 2024/01/01/ 2024;118:107996. doi:https://doi.org/10.1016/j.pec.2023.107996
11. Tariq J, Gupta L. Safety and efficacy of COVID-19 vaccines in pregnant women with rheumatic diseases: an immunologic perspective. *Rheumatol Int*. Aug 2021;41(8):1545-1547. doi:10.1007/s00296-021-04918-z
12. Butt IN, van Eeden C, Burns KK, et al. COVID-19 Vaccination Perceptions in Patients With Rheumatic Disease: A Cross-Sectional Online Survey. *J Rheumatol*. May 2023;50(5):690-696. doi:10.3899/jrheum.220765
13. Shaw YP, Hustek S, Nguyen N, et al. Rheumatic disease patient decision-making about COVID-19 vaccination: a qualitative analysis. *BMC Rheumatol*. Nov 29 2022;6(1):76. doi:10.1186/s41927-022-00307-6
14. Safary A, Esalatmanesh K, Eftekharsadat AT, Jafari Nakjavani M-R, Khabbazi A. Autoimmune inflammatory rheumatic diseases post-COVID-19 vaccination. *International Immunopharmacology*. 2022/09/01/ 2022;110:109061. doi:https://doi.org/10.1016/j.intimp.2022.109061
15. Wantha O, Mahakkanukrauh A, Tuydaung K, et al. Attitudes and factors affecting decision-making regarding COVID-19 vaccination among autoimmune rheumatic disease patients. *International Journal of Rheumatic Diseases*. 2023;26(4):751-758. doi:https://doi.org/10.1111/1756-185X.14644
16. Widhani A, Hasibuan AS, Rismawati R, et al. Efficacy, Immunogenicity, and Safety of COVID-19 Vaccines in Patients with Autoimmune Diseases: A Systematic Review and Meta-Analysis. *Vaccines*. 2023;11(9). doi:10.3390/vaccines11091456
17. Assawasaksakul T, Lertussavavivat T, Sathitratanacheewin S, et al. Comparison of Immunogenicity and Safety of Inactivated, Adenovirus-Vectored, and Heterologous

Adenovirus-Vectored/mRNA Vaccines in Patients with Systemic Lupus Erythematosus and Rheumatoid Arthritis: A Prospective Cohort Study. *Vaccines (Basel)*. 2022; 26;10(6):853. doi: 10.3390/vaccines10060853.

18. Roseti L, Grigolo B. COVID-19 and rheumatic diseases: A mini-review. *Front Med (Lausanne)*. 2022;9:997876. doi:10.3389/fmed.2022.997876
19. Fu XL, Qian Y, Jin XH, et al. COVID-19 in patients with systemic lupus erythematosus: A systematic review. *Lupus*. May 2022;31(6):684-696. doi:10.1177/09612033221093502
20. Department of Medical Services, Ministry of Public Health, Thailand. Clinical Practice Guideline for Diagnosis, Treatment, and Prevention of Coronavirus Disease 2019 (COVID-19) in Hospital Settings, 17 April 2021 [Internet]. Nonthaburi: Ministry of Public Health; 2021 [cited 2026 Feb 14]. Available from: https://covid19.dms.go.th/backend///Content//Content_File/Covid_Health/Attach/256404171148 30AM_CPG_COVID-19%20_ns_%2017apr%202021.pdf
21. Narongtanupol P, Narongtanupol P. Immune response after receiving Covid-19 vaccination. *Academic journal of community public health*. 2022;8:178-194.
22. Palazzo L, Lindblom J, Kihlgren Olsson E, Nikiphorou E, Wincup C, Saha S, et al. Breakthrough SARS-CoV-2 infection in fully vaccinated patients with systemic lupus erythematosus: results from the COVID-19 Vaccination in Autoimmune Disease (COVAD) study. Rheumatol Int. 2024;44(10):1923-33. doi: 10.1007/s00296-024-05682-6.
23. Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand. Guidelines for the Implementation of Adult Immunization Programs, 2023 [Internet]. Nonthaburi: Department of Disease Control; 2023 [cited 2026 Feb 14]. Available from: https://ddc.moph.go.th/uploads/publish/1366120230209074448.pdf