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Original Article

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Autoimmune Rheumatic Diseases After Inactivated and Adenoviral COVID-19 Vaccination: A Multicenter Observational Study

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Abstract

Background: The present study was conducted to investigate the clinical features, latency, and vaccine platform–specific associations of new-onset Autoimmune Inflammatory Rheumatic Diseases (AIRDs) following inactivated and adenoviral vector COVID-19 vaccination in a Middle Eastern cohort.

Methods: This retrospective observational study included 121 patients diagnosed with new-onset AIRDs within 30 days of COVID-19 vaccination between March 2021 and December 2022. Data were collected from five rheumatology centers in Mashhad, Iran. Clinical characteristics, vaccine type, latency, AIRD subtype, and disease severity were analyzed using chi-square, Kruskal–Wallis, and Holm-adjusted post-hoc tests.

Results: Among 894,924 vaccinated individuals, 121 patients (86.0% female; mean age 39.2±12.7 years) developed new-onset AIRDs, corresponding to a referral-based frequency of 0.013%. The most frequently administered vaccines were AstraZeneca (54.5%) and Sinopharm (33.1%). Vasculitis (29.7%) and seronegative spondyloarthropathy (23.1%) were the most common diagnoses. The mean latency to symptom onset was 15.1±8.9 days. While the AIRD subtype distribution did not differ by vaccine type (p=0.993), disease severity was significantly associated with the vaccine platform (χ^2=13.81, p=0.032; Cramér's V=0.240), with fewer severe cases observed in Sinopharm recipients (Holm-adjusted p=0.033). No correlation was found between latency and age, inflammatory markers, or disease severity.

Conclusion: These findings provide one of the first platform-associated observational analyses of new-onset AIRDs following non-mRNA COVID-19 vaccination. The observed differences in disease severity across vaccine types suggest a potential immunological gradient that warrants further investigation in prospective mechanistically oriented studies.

Keywords: Autoimmune diseases, COVID-19 vaccines, Rheumatic diseases, Rheumatology, Spondylarthropathies, Vaccination

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Introduction

Autoimmune Inflammatory Rheumatic Diseases (AIRDs) encompass a diverse group of disorders that involve systemic inflammation, autoantibody production, and tissue-specific immune dysregulation (1). These conditions, including Rheumatoid Arthritis (RA), Systemic Lupus Erythematosus (SLE), ANCA-Associated Vasculitis (AAV), and other systemic autoimmune disorders, affect millions of people globally and impose substantial healthcare burdens through chronic disability and organ damage (2,3).

The etiology of AIRDs is multifactorial, with genetic susceptibility, infections, hormonal factors, and environmental triggers such as vaccinations recognized as contributors to disease onset or flares in predisposed individuals (4). Although associations between vaccines and autoimmune events are rare, historical reports have documented new-onset or exacerbated AIRDs following influenza, hepatitis B, and Human Papillomavirus (HPV) vaccines (5).

These phenomena have been linked to immunological mechanisms, including molecular mimicry, bystander activation, epitope spreading, and adjuvant-induced autoimmunity (6,7). The clinical significance of these associations extends beyond individual case reports, as post-vaccination autoimmune events can present diagnostic challenges, with symptoms potentially overlapping with those of viral infections or stress-related conditions.

The global rollout of COVID-19 vaccines has renewed scientific attention from these associations, particularly since billions of doses have been administered worldwide. A 2023 scoping review identified over 300 cases of immune-mediated adverse events following COVID-19 vaccination, with approximately 30% involving new-onset AIRDs. Notably, most of these cases followed mRNA-based vaccines such as BNT162b2 (Pfizer, BioNTech) or mRNA-1273 (Moderna), leaving a critical evidence gap regarding non-mRNA platforms (8). This disparity reflects the broader challenges in global pharmacovigilance systems.

In low- and middle-income countries, where inactivated and viral vector–based COVID-19 vaccines were widely administered, post-marketing surveillance systems are often less developed than those in high-income settings that predominantly used mRNA vaccines, potentially leading to systematic underdetection of autoimmune complications (9-12). This context is particularly relevant in Iran, where more than 70% of the population received non-mRNA vaccines during the early phases of national vaccination campaigns (13,14).

Despite their extensive use, reports of autoimmune rheumatic diseases following inactivated or vector-based vaccines remain limited. For example, Guo and Liu summarized 12 cases of new-onset AIRDs following Sinopharm vaccination compared to over 100 reports associated with the Pfizer–BioNTech vaccine (15). This underrepresentation may reflect both differential surveillance capacity and potential platform-specific differences in autoimmune risk profiles, underscoring the need for region-specific observational data.

Several observational studies and reviews suggest a typical latency period of 7–14 days from vaccination to the onset of AIRD symptoms. Ursini *et al* reported a mean onset of 9 days across 30 cases (16), whereas Kawasaki *et al* documented average latencies of 11–12 days in a pooled dataset including 7 cases of RA, 37 AAV, and 18 SLE following COVID-19 vaccination (17).

Although most patients respond to immunosuppressive therapy, these cases raise important questions about temporal association, causality, and risk stratification (18). The clinical and public health implications of this gap in evidence are substantial. Accurate risk-benefit assessments for different vaccine platforms require comprehensive safety data across diverse populations and healthcare systems (19). Moreover, understanding platform-specific autoimmune risks may inform vaccination strategies for immunocompromised individuals and those with pre-existing autoimmune conditions, particularly in regions where multiple vaccine options are available (20).

To address this critical evidence gap, the present study investigated the clinical features and timing of new-onset AIRDs in individuals receiving COVID-19 vaccination in Mashhad, Iran, between March 2021 and December 2022. By focusing on inactivated and viral vector platforms in a population historically underrepresented in post-vaccination safety surveillance, the current study was aimed at providing systematic, population-level data to

guide future pharmacovigilance and autoimmune disease research, while acknowledging the inherent limitations of observational, temporally associated data in establishing causality.

Materials and Methods

This retrospective observational study examined individuals diagnosed with new-onset AIRDs following COVID-19 vaccination. The study period spanned from March 1, 2021, to December 31, 2022, and included patients evaluated at two academic rheumatology clinics affiliated with the Mashhad University of Medical Sciences (Imam Reza and Ghaem Hospitals), as well as three private rheumatology practices in Mashhad, Iran. Both outpatient and hospitalized patients were included to reflect the full range of disease severity. Diagnostic and classification procedures were consistently applied across all the settings. No systematic recruitment from vaccination centers, primary care clinics, or registries was performed.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) a new-onset AIRD diagnosed within 30 days following the administration of a COVID-19 vaccine approved by the Iran Food and Drug Administration (IFDA) in Iran, and (2) no documented history of autoimmune or inflammatory rheumatic disease.

Exclusion criteria included symptom onset beyond 30 days post-vaccination, prior diagnosis of AIRDs, alternative musculoskeletal diagnoses (*e.g.*, osteoarthritis and fibromyalgia), and incomplete medical records that could not be resolved through follow-up.

Diagnostic criteria

AIRDs were defined using internationally accepted classification systems. RA was diagnosed using the 2010 ACR/EULAR criteria (21), SLE using the 2019 EULAR/ACR criteria (22), and AAV according to the 2012 Chapel Hill Consensus definitions (23). Other conditions, including Scleroderma (SSc), Dermatomyositis (DM), and Mixed Connective Tissue Disease (MCTD), were diagnosed based on the relevant ACR or EULAR guidelines. In cases of atypical or overlapping presentations, the final diagnosis was made by expert consensus among at least two rheumatologists.

Data collection

Clinical data were retrospectively extracted from patient records using a structured checklist developed for this study. The variables included demographic information (age, sex, education level, occupation, and smoking status), COVID-19 infection history and severity, vaccine type and administration date, number of doses, booster status, and latency from vaccination to symptom onset. Additional data included comorbidities, laboratory findings (*e.g.*, ESR and CRP), imaging results, treatment modalities, and disease classification. Patients with missing data were contacted *via* telephone; if the data could not be confirmed, cases were excluded.

COVID-19 severity was categorized into three clinical groups aligned with the NIH COVID-19 clinical spectrum (24). Mild disease was defined as asymptomatic or PCR-confirmed infection without hospitalization, pulmonary involvement, or hypoxemia ($SpO_2 \geq 94\%$ on room air). Severe disease was defined by the presence of pulmonary involvement, hypoxemia ($SpO_2 < 94\%$), ICU admission, or receipt of COVID-19–related systemic immunosuppressive therapy. Cases not meeting the criteria for mild or severe disease were classified as moderate.

The clinical severity of AIRDs was categorized as mild, moderate, or severe based on rheumatologist assessment at presentation using a structured clinical framework applicable across heterogeneous conditions. Severity assessment considered objective features, including the extent of organ involvement, documented functional impairment, and the intensity of systemic immunosuppressive therapy required. Severe disease was defined as major organ involvement and/or the need for high-intensity immunosuppressive treatment, whereas mild disease reflected limited organ involvement with minimal functional impact. Cases not meeting the criteria for mild or severe disease were classified as moderate. Disease-specific activity indices were not uniformly applied due to heterogeneity of diagnoses and retrospective data constraints.

Vaccination dates were verified using national

vaccination certificates or electronic health records. Symptom onset was defined as the date of the first patient-reported symptom subsequently corroborated by a rheumatologist.

Statistical analysis

All analyses were performed using Python (version 3.12) with the Statsmodels, Pandas, NumPy, and SciPy libraries.

Descriptive statistics were used to summarize the demographic and clinical variables. Categorical variables were compared using the chi-square test or Fisher's exact test, where appropriate. The Kruskal–Wallis test was used to compare non-normally distributed continuous variables (*e.g.*, latency across AIRD groups), followed by Holm-corrected post-hoc comparisons. Associations between ordinal or continuous variables (*e.g.*, age, ESR, CRP level, latency, and severity) were analyzed using Spearman's rank correlation.

Given referral-based sampling and the lack of systematic case ascertainment, the true incidence rates could not be calculated. Therefore, the results were reported as observed frequencies among referred cases, without implying population-level risk.

Results

Study population and baseline characteristics

Between March 2021 and December 2022, 894,924 individuals were vaccinated in Mashhad. Among them, 121 were referred to rheumatology clinics and diagnosed with new-onset AIRDs within 30 days post-vaccination. This corresponds to an observed referral-based proportion of 121 cases among approximately 895,000 vaccinated individuals within the catchment area, reflecting cases identified through participating referral centers rather than systematic population surveillance.

The majority received the AstraZeneca/ChAdOx1 vaccine (n=66, 54.5%), followed by Sinopharm (n=40, 33.1%), CoBarekat (n=10, 8.3%), and Sputnik V (n=5, 4.1%).

The mean age of the affected patients was 39.19±12.67 years, and the majority were female (86.0%). Most patients (66.1%) had a history of COVID-19, and the median time between recovery and vaccination was 45 days (IQR: 38–80). The mean latency between vaccination and onset of AIRD symptoms was 15.11±8.86 days. Adverse effects following vaccination were reported by 65.3% of the patients. Disease severity at presentation was categorized as mild in 46.3%, moderate in 33.1%, and severe in 20.7% of the cases. Additional demographic and laboratory features are summarized in table 1.

Spectrum and frequency of AIRDs

The most frequently diagnosed AIRDs were vasculitis (29.7%) and seronegative spondyloarthropathies (SpAs) (23.1%), followed by reactive arthritis (12.4%), RA (10.7%), SLE (9.9%), and undifferentiated inflammatory arthritis (9.9%). A detailed breakdown of these subtypes was presented in table 2. Latency periods varied significantly by diagnostic category (Kruskal–Wallis χ^2=31.77, df=3, p=0.016); however,

Table 1. Demographic and clinical characteristics of patients with new-onset AIRDs following COVID-19 vaccination

Variable		Value
Age (*yrs*) Mean±SD		39.19±12.67
Gender (N, %)	Female	104(86.0%)
	Male	17(14.0%)
Latency (days between vaccination and AIRD onset) (Mean±SD)		15.11±8.86
Prior COVID-19 infection (N, %)	Yes	80(66.1%)
	No	41(33.9%)
COVID-19 infection severity (N, %)	Mild	51(42.1%)
	Moderate	27(22.3%)
	Severe	3(2.5%)
Vaccine type (N, %)	AstraZeneca	66(54.5%)
	Sinopharm	40(33.1%)
	CoBarekat	10(8.3%)
	Sputnik V	5(4.1%)
Clinical disease severity (N, %)	Mild	56(46.3%)
	Moderate	40(33.1%)
	Severe	25(20.7%)
ESR (*mm/hr*) (Median, [IQL])		43(38–53)
CRP (*mg/L*) (Median, [IQL])		15(8–60)

Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

Table 2. The observed frequency of autoimmune rheumatic diseases following COVID-19 vaccination [a]

Autoimmune rheumatic disease	Subscale	No	%	Total	Observed frequency of AIRD following COVID-19 vaccination
Seronegative spondyloarthropathy	Psoriatic arthritis	9	7.4	28 (23.1%)	0.0033%
	Reactive arthritis	15	12.4		
	Ankylosing spondylitis	4	3.3		
Vasculitis	ANCA-associated Vasculitis	11	9.1	36 (29.7%)	0.0042%
	Temporal arteritis	3	2.5		
	Behçet's disease	6	5		
	Takayasu arteritis	5	4.1		
	Isolated eye vasculitis	1	0.8		
Inflammatory myopathies	Dermatomyositis	3	2.5	4 (3.3%)	0.0004%
	IBM myositis	1	0.8		
Connective Tissue Diseases (CTD)	SLE	12	9.9	36 (29.7%)	0.0042%
	RA	13	10.7		
	SS	5	4.1		
	SSc	4	3.3		
	APS	2	1.7		
Other AIRDs	Sarcoidosis	3	2.5	17 (14%)	0.0020%
	Still's disease	1	0.8		
	Granulomatous mastitis	1	0.8		
	Undifferentiated inflammatory arthritis	12	9.9		

[a] Kruskal–Wallis Test for Latency Differences Between Groups (χ^2=31.77, df=3, p=0.016). Post-hoc (Holm-corrected): All pairwise comparisons: p>0.05, Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

post-hoc Holm-corrected comparisons did not yield statistically significant pairwise differences (p>0.05).

Association between vaccine type and disease outcomes

No significant association was found between the AIRD subtype and vaccine type (χ^2=38.91, df=63, p=0.993). However, vaccine type was significantly associated with disease severity (χ^2=13.81, df=6, p=0.032; Cramér's V=0.240), with post-hoc analysis showing that patients vaccinated with Sinopharm had significantly fewer severe AIRDs than expected (adjusted p=0.033). The detailed findings are presented in table 3A.

Associations with disease severity

Sex was significantly associated with disease severity (χ^2=10.36, df=2, p=0.006), with a higher proportion of moderate and severe cases in females compared than in males. No significant association was observed between disease severity and prior COVID-19 infection (χ^2=0.64, df=2, p=0.728) or with the severity of COVID-19 illness (χ^2=0.73, df=4, p=0.948). These findings are presented in tables 3B, 3C and 3D.

Correlation analysis

Spearman correlation analyses revealed no statistically significant relationships between latency

Table 3A. Comparison of adverse effects and diseases severity following COVID-19 vaccination in AIRD patients (n=121)

Vaccine		Adverse effects manifested immediately after vaccination		Disease severity		
		No	Yes	Mild	Moderate	Severe
AstraZeneca	N	16	50	27	22	17
	%	24.2	75.8	40.9	33.3	25.8
Sinopharm [a]	N	24	16	24	14	2
	%	60	40	60	35	5
Sputnik V	N	2	3	3	1	1
	%	40	60	60	20	20
CoBarecat	N	0	10	2	3	5
	%	0	100	20	30	50
χ^2		19.85		13.81		
p-value		<0.001 [b]		0.032		

a: Cramér's V = 0.240. b: Post-hoc Adjusted Residuals Sinopharm × Severe: z = –2.99, p=0.033.

Table 3B. Association between sex and AIRD severity

Severity	Female	Male	Total
Mild	42	14	56
Moderate	38	2	40
Severe	24	1	25
Total	104	17	121

χ^2 =10.364, p-value=0.006, Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

Table 3C. Association between COVID-19 severity and AIRD severity

AIRD severity	Mild COVID	Moderate COVID	Severe COVID	Total
Mild	23	11	1	35
Moderate	17	11	1	29
Severe	11	5	1	17
Total	51	27	3	81

χ^2 =0.728, p-value=0.948, Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

Table 3D. Association between prior COVID-19 infection and AIRD severity

AIRD severity	Prior COVID (Yes)	No prior COVID	Total
Mild	35	21	56
Moderate	28	12	40
Severe	17	8	25
Total	80	41	121

χ^2 =0.636, p-value=0.728, Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

and inflammatory markers (ESR: ρ=–0.01, p=0.870; CRP: ρ=0.01, p=0.880), or between age and latency (ρ=0.17, p=0.059). However, CRP (ρ=0.21, p=0.021) and ESR (ρ=0.19, p=0.043) were both modestly correlated with AIRD severity. The results are summarized in table 4.

Discussion

While mRNA-based COVID-19 vaccines have dominated autoimmune safety surveillance, data on

Table 4. Spearman correlation coefficients between key clinical variables

Variable	Latency (ρ, p-value)	ESR (ρ, p-value)	CRP (ρ, p-value)	Age (ρ, p-value)	AIRD severity (ρ, p-value)
Latency	-	–0.01, 0.870	0.01, 0.880	0.17, 0.059	0.02, 0.791
ESR	–0.01, 0.870	-	0.38, <0.001	0.04, 0.650	0.19, 0.043
CRP	0.01, 0.880	0.38, <0.001	-	0.09, 0.310	0.21, 0.021
Age (*yrs*)	0.17, 0.059	0.04, 0.650	0.09, 0.310	-	0.05, 0.620
AIRD severity	0.02, 0.791	0.19, 0.043	0.21, 0.021	0.05, 0.620	-

Autoimmune Inflammatory Rheumatic Diseases (AIRDs).

non-mRNA platforms remain sparse, particularly in low- and middle-income regions where inactivated and adenoviral vector vaccines were the primary tools of mass immunization. The present study addressed this overlooked area by systematically describing 121 new-onset AIRD cases diagnosed within 30 days of COVID-19 vaccination in Mashhad, Iran, where over 70% of the population received non-mRNA vaccines. This provides one of the largest observational cohorts focused exclusively on Sinopharm, AstraZeneca, CoBarekat, and Sputnik V.

The overall referral-based frequency of 0.013% (121 of approximately 895,000 vaccinated individuals) underscores the rarity of such events. However, this aligns with broader international reports suggesting that post-vaccination AIRDs occur in a minimal subset of recipients. In a multicenter observational study, Cavagna *et al* reported 267 new-onset inflammatory rheumatic cases following either SARS-CoV-2 infection or COVID-19 vaccination, with approximately 70% of the cases occurring post-vaccination. The reported diagnoses included inflammatory arthritis, vasculitis, and MCTD. However, the authors did not stratify cases by vaccine platform or provide latency data, limiting direct comparison with platform-specific cohorts, such as the current study's (8). Similarly, Ursini *et al* described 30 cases of systemic rheumatologic syndromes that occurred after COVID-19 vaccination, including inflammatory arthritis, vasculitis, and MCTD. Their cohort included recipients of mRNA, inactivated, and adenoviral vector vaccines, with a mean latency of 9 days and generally favorable responses to corticosteroids or conventional immunosuppressive therapy (16). Kawasaki *et al* summarized 62 cases (including 37 AAV and 18 SLE cases) with an average onset of 11–12 days (17). The mean latency of 15.1 days falls within this range, though slightly longer, possibly reflecting platform differences or demographic variation.

In terms of the disease spectrum, the most common diagnoses were vasculitis (29.7%) and SpA (23.1%), followed by reactive arthritis, RA, and SLE. This distribution overlaps with the global case series, but with notable regional distinctions. While Kawasaki *et al* and Safary emphasized AAV and RA as prominent post-vaccine AIRDs (17,25), the present study's cohort exhibited a higher proportion of Behçet's disease and undifferentiated vasculitides, consistent with the endemicity of vasculitis in Iran (26,27). Furthermore, 66.1% of the current study's patients had a history of COVID-19, potentially implicating post-viral immune priming as a modifying factor in the vaccine response, a possibility acknowledged but unquantified in prior reviews (15,16).

The most novel aspect of present findings lies in the association between the vaccine platform and disease severity. Although no significant difference in AIRD subtype distribution by vaccine type was observed, patients who received Sinopharm exhibited significantly fewer severe AIRD presentations than expected based on the overall distribution of severity across vaccine types (Holm-corrected post-hoc p=0.033). In contrast, AstraZeneca recipients had a higher tendency toward moderate or severe forms. This trend is not consistently reflected in the existing

literature, which largely aggregates vaccine types or focuses on mRNA-related outcomes (8,16,25). The study data suggest that inactivated vaccines may elicit milder autoimmune manifestations, whereas adenoviral vector platforms may provoke more robust responses in predisposed individuals.

Therefore, this hypothesis is biologically plausible. Inactivated vaccines, such as Sinopharm, primarily engage Toll-Like Receptor 4 (TLR4) and activate the inflammasome through classical adjuvant pathways (28,29), whereas adenoviral vectors, such as ChAdOx1 (AstraZeneca), are known to stimulate TLR9 and the cGAS–STING pathway, inducing potent type I interferon responses (30,31). These divergent innate immune triggers can influence the amplitude and tissue tropism of adaptive responses, particularly in individuals with subclinical autoreactivity. Ursini *et al* and Safary highlighted similar mechanistic considerations, although most studies have stopped short of linking specific pathways to clinical phenotypes (16,25). These findings warrant targeted investigations into the underlying immune signatures and vaccine-induced autoimmune pathways.

The latency distribution also supports this dichotomy. While the literature reports an average onset of 7-12 days post-vaccination, the data show a wider range (mean: 15.1 days), with delayed cases more frequently associated with inactivated vaccines. Interestingly, a borderline correlation between age and latency (ρ=0.17, p=0.059) was observed. Although not statistically significant, this trend suggests that older individuals experience a modest delay in immune activation or symptom onset following vaccination. The absence of significant correlations between latency and CRP, ESR, or disease severity further supports the idea that latency reflects a platform- or host-dependent immune processing variable rather than general inflammatory activity.

The study findings also reinforce the need for region-sensitive pharmacovigilance. Most global reviews are based on mRNA-centric vaccination programs in high-income settings, creating blind spots in platform-specific safety profiles (32,33). As highlighted in both WHO reports and recent reviews, passive surveillance may underestimate rare autoimmune outcomes in low- and middle-income countries, notably when electronic medical records or centralized registries are lacking (9,12). Structured clinic-based datasets, such as the present study's, can help fill this gap, especially when paired with rigorous classification criteria and platform-specific analysis.

Advantages and limitations

The present study was subject to several limitations. The retrospective design introduced a referral bias favoring symptomatic cases, thereby precluding the estimation of risk at the population level. The absence of a matched control group prevented the inference of formal causality. Additionally, some patients may have had subclinical disease prior to vaccination, and the estimation of latency partially relied on self-reported symptoms. Furthermore, the study's focus on a single region limited its generalizability, and the underrepresentation of certain vaccine types (*e.g.*, Sputnik V) constrains the comparative analysis. A significant limitation was the referral-based nature of case ascertainment. Although the proportion of cases was calculated using the estimated vaccinated population within the catchment area, cases were identified through participating referral centers rather than systematic population surveillance. Consequently, the reported proportion should not be interpreted as a population-level incidence or frequency of autoimmune rheumatic diseases following COVID-19 vaccination.

Nonetheless, this study presented one of the largest case series of post-vaccination AIRDs after non-mRNA platforms were systematically classified using international criteria. The integration of latency, vaccine type, and severity patterns, particularly the signal of reduced severity of inactivated vaccines, offers a hypothesis-generating contribution. This adds a geographic and immunological context to the global literature in which such disaggregation is often lacking.

Conclusion

New-onset AIRDs following COVID-19 vaccination were rare in this large real-world cohort from a non-mRNA-dominant setting. However, platform-specific differences in clinical severity were observed. Inactivated vaccines are more often associated with milder disease, whereas adenoviral vector platforms are more frequently linked to moderate-to-severe

presentations.

These findings generate important hypotheses regarding vaccine-induced immune modulation and highlight the need for future studies that integrate immunophenotyping with regional surveillance data. Strengthening pharmacovigilance systems, particularly in low- and middle-income settings, is essential for identifying platform-specific safety signals in autoimmune-prone populations.

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Conflict of Interest

There are no conflicts of interest, financial or otherwise, among the authors.

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