Association Between Newer COVID-19 Vaccines and COVID-19 Related Hospitalizations Among People with Autoimmune Rheumatic Diseases in the U.S. National COVID Cohort Collaborative (N3C)

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CONCLUSIONS

After accounting for important covariates, we observed a substantially decreased independent odds of COVID-related hospitalization, need for mechanical ventilation or ECMO, and death among people with AIRD that received a booster or updated 2023-2024 COVID-19 vaccine compared to initial series alone or unvaccinated statuses.

BACKGROUND

- People with autoimmune rheumatic diseases (AIRD) are at higher risk for serious complications from COVID-19 infection
- Data is lacking on outcomes related to the updated (2023-2024) COVID-19 vaccine in this population

OBJECTIVES

- To assess the association between vaccination status and COVID-19-related hospitalizations, need for mechanical ventilation or extracorporeal membrane oxygenation (ECMO), and death

METHODS

- **Design**: retrospective cohort study
- **Setting**: National Clinical Cohort Collaborative (NC3)
- **Population**: adults with AIRD and incident positive COVID-19 testing between 12/2020 – 12/2023
- **Exposure**: Time-varying vaccination status defined as: **unvaccinated** (no record on file), **initial series completed** (2 mRNA doses or 1 Janssen dose), **boosted** (initial series completed + booster or bivalent dose), or **updated** vaccinated (with 1+ updated 2023-24 COVID-19 vaccine)
- **Primary outcome**: presence of an inpatient hospitalization occurring during the period 3 days before and up to 14 days after positive SARS-CoV-2 testing
- **Analysis**: Multivariable logistic regression model, adjusted for repeating measures & participating site

RESULTS

- Cohort included 60,980 patients, of whom 10% received updated COVID-19 vaccine (**Table 1**)
- After adjusting for covariates, patients with AIRD who had received an updated vaccine dose had 69% (aOR=0.31, 95% 95% CI 0.28, 0.34) lower odds of COVID-19-related hospitalization compared to unvaccinated people (**Figure 1**)
- Male sex, older age, Black race, exposure to glucocorticoids, immunosuppressants, or CD20 inhibitors such as rituximab, having hypertension, more comorbidities, and higher social vulnerability were associated with a higher likelihood of COVID-19-related hospitalization
- Compared to unvaccinated status, the updated vaccine was associated with a lower odds of mechanical ventilation or ECMO (aOR=0.24, 95% CI 0.17, 0.33) and death (aOR=0.03, 95% CI 0.02, 0.06)

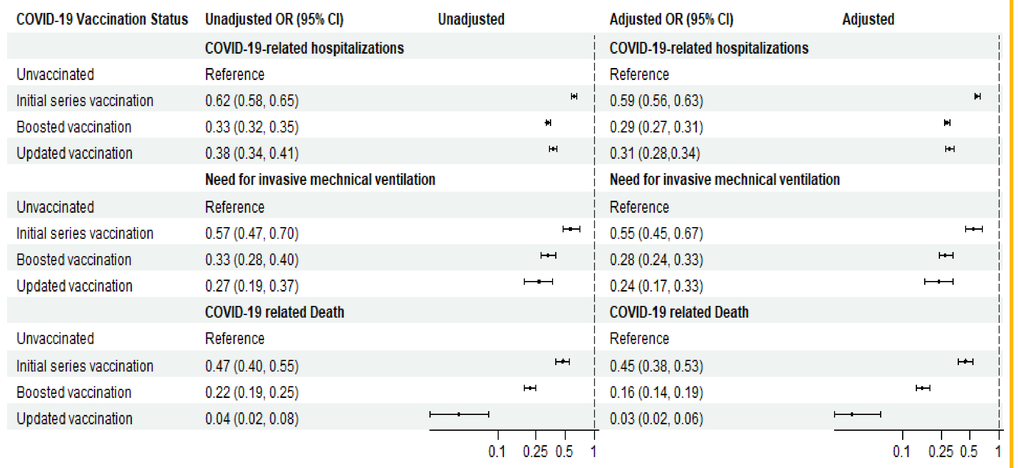

Figure 1. Association of COVID-19 vaccination status and covariates with COVID-19-related hospitalization among patients with autoimmune rheumatic conditions.

OR and CI presented on a logarithmic scale. Model was adjusted for: COVID-19 vaccination status, sex, age group, race and ethnicity, autoimmune rheumatic condition, medication use, tobacco use, presence of hypertension, Charlson Comorbidity Index (excluding autoimmune rheumatic conditions), and social vulnerability index.

RESULTS

Table 1. Baseline characteristics of cohort by COVID-19 vaccination status.

Characteristics	No. (%) Overall N3C sample N=60,980	COVID-19 Vaccination Status Group				
		Unvaccinated n=17,003 (27.9%)	Initial Series Vaccination n=10,394 (17.0%)	Boosted n=27,247 (44.7%)	Updated n=6,336 (10.4%)	P-value
Sex, female	46,043 (76%)	12,743 (75%)	8,048 (77%)	20,478 (75%)	4,774 (75%)	<0.001
Age, median (IQR)	62 (50, 73)	58 (46, 70)	58 (46, 70)	64 (53, 74)	65 (54, 74)	<0.001
Age Groups (years)						<0.001
<50	15,100 (25%)	5,338 (31%)	3,252 (31%)	5,345 (20%)	1,165 (18%)	
≤50 to <65	19,120 (31%)	5,544 (33%)	3,400 (33%)	8,342 (31%)	1,834 (29%)	
≤65 to <75	13,902 (23%)	3,220 (19%)	1,969 (19%)	6,899 (25%)	1,814 (29%)	
>=75	12,858 (21%)	2,901 (17%)	1,773 (17%)	6,661 (24%)	1,523 (24%)	
Race and Ethnicity[a]						<0.001
White non-Hispanic	44,876 (74%)	12,369 (73%)	7,394 (71%)	20,286 (74%)	4,827 (76%)	
Black/ African American Non-Hispanic	7,896 (13%)	2,091 (12%)	1,411 (14%)	3,479 (13%)	915 (14%)	
Hispanic or Latino any Race	5,204 (9%)	1,650 (10%)	1,038 (10%)	2,145 (8%)	371 (6%)	
Multiple races, other races[b]	3,004 (5%)	893 (5%)	551 (5%)	1,337 (5%)	223 (4%)	
Autoimmune rheumatic condition						<0.001
Inflammatory arthritis[c]	32,609 (53%)	9,218 (54%)	5,617 (54%)	14,390 (53%)	3,384 (53%)	
Sjögren's syndrome	4,975 (8%)	1,175 (7%)	794 (8%)	2,378 (9%)	628 (10%)	
Polymyalgia rheumatica	4,260 (7%)	943 (6%)	600 (6%)	2,255 (8%)	462 (7%)	
Vasculitis[d]	7,108 (12%)	1,936 (11%)	1,218 (12%)	3,254 (12%)	700 (11%)	
Systemic lupus erythematosus	9,316 (15%)	2,930 (17%)	1,762 (17%)	3,752 (14%)	872 (14%)	
Other connective tissue diseases[e]	2,712 (4%)	801 (5%)	403 (4%)	1,218 (5%)	290 (5%)	
Broad Drug Category						
Biologic DMARDs[f]	6,758 (11%)	1,598 (9%)	1,040 (10%)	3,369 (12%)	751 (12%)	<0.001
Conventional synthetic DMARDs[g]	14,099 (23%)	3,603 (21%)	2,147 (21%)	6,914 (25%)	1,435 (23%)	<0.001
Apremilast	290 (1%)	93 (1%)	41 (<1%)	126 (1%)	30 (1%)	0.3
Janus kinase inhibitors	958 (2%)	271 (2%)	144 (1%)	434 (2%)	109 (2%)	0.3
Glucocorticoids	18,079 (30%)	4,938 (29%)	3,009 (29%)	8,458 (31%)	1,674 (26%)	<0.001
Immunosuppressants[h]	4,317 (7%)	1,100 (7%)	638 (6%)	2,132 (8%)	447 (7%)	<0.001
CD20 inhibitors (rituximab)	1,464 (2%)	354 (2%)	229 (2%)	705 (3%)	176 (3%)	<0.001
Tobacco use	6,737 (11%)	2,205 (13%)	1,245 (12%)	2,667 (10%)	620 (10%)	<0.001
Hypertension	37,958 (62%)	9,675 (57%)	6,131 (59%)	17,970 (66%)	4,182 (66%)	<0.001
Charlson Comorbidity Index, Median (IQR)	2 (1, 4)	2 (0, 4)	2 (0, 4)	2 (1, 4)	2 (1, 4)	<0.001
Social Vulnerability Index[i]						<0.001
High	14,828 (24%)	4,207 (25%)	2,765 (27%)	6,141 (23%)	1,715 (27%)	
Obesity (BMI ≥30)	37,757 (62%)	10,451 (61%)	6,593 (63%)	16,764 (62%)	3,949 (62%)	0.003

[a]Race and ethnicity were self-identified in the electronic medical record. [b]Other category included multiple, unknown, or self-reported other race and ethnicity. [c]Inflammatory arthritis include rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, enteropathic arthritis, and reactive arthritis. [d]Vasculitis includes Behcet's disease, anti-neutrophil cytoplasmic antibodies (ANCA) associated vasculitis, giant cell arteritis, and polyarteritis nodosa. [e]Other connective tissue diseases include polymyositis, dermatomyositis, and systemic sclerosis. [f]Biologic DMARDs include TNFi, IL-6, CTLA, IL-1, IL-17, and IL-12/23 biologics, complements inhibitors, belimumab, and anifrolumab. [g]Conventional synthetic DMARDs include methotrexate, sulfasalazine, hydroxychloroquine, and leflunomide. [h]Immunosuppressants include mycophenolate, azathioprine, 6-mercaptopurine, and cyclophosphamide. [i]Social vulnerability index categories as follows: High (>0.65), medium (0.35,0.65), low (<0.35).

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